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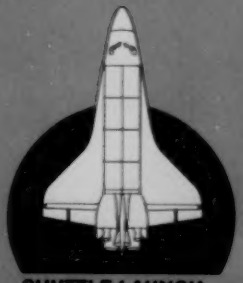

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INTRODUCTION

Scientific and Technical Aerospace Reports (STAR) is a major component of a comprehensive National Aeronautics and Space Administration information system covering aeronautics, space, and supporting disciplines. *STAR* is issued on the 8th and 23rd of each month and announces current publications of the following types:

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By arrangement between NASA and the Smithsonian Science Information Exchange (SSIE), a separate section of information on aerospace-related *On-Going Research Projects* is inserted into each issue of *STAR*. The insert presents titles of active NASA grants and university contracts, summary portions of recently updated *NASA Research and Technology Objectives and Plans (RTOPs)*, and notices of non-NASA research projects that were funded in the most recent or current fiscal year. The latter are selected by SSIE. The project announcements in the insert are arranged by *STAR* divisions but are otherwise entirely separate from *STAR*. They are not indexed nor machine-searchable by NASA. Current and retrospective searches are available from SSIE, 1730 M Street, N.W., Washington, D.C. 20036.

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Subject scope of *STAR*, *IAA*, and *On-Going Research Projects* includes all aspects of aeronautics and space research and development, supporting basic and applied research, and applications. Aerospace aspects of earth resources, energy development, conservation, oceanography, environmental protection, urban transportation, and other topics of high national priority are also covered.

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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

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Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

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Includes passenger and cargo air transport operations; and aircraft accidents.

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Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

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05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 2370

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 2372

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 2372

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 2377

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09 RESEARCH AND SUPPORT FACILITIES (AIR) 2378

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For related information see also *14 Ground Support Systems and Facilities (Space)*.

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Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

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Includes powered and free-flight trajectories; and orbit and launching dynamics.

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For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

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19 SPACECRAFT INSTRUMENTATION 2382

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20 SPACECRAFT PROPULSION AND POWER 2382

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

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23 CHEMISTRY AND MATERIALS (GENERAL) N.A.

Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS 2383

Includes laminates.

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Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

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Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

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28 PROPELLANTS AND FUELS 2393

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

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Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

For related information see also *Physics*.

31 ENGINEERING (GENERAL) 2397

Includes vacuum technology; control engineering; display engineering; and cryogenics.

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Includes land and global communications; communications theory; and optical communications.

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Includes product sampling procedures and techniques; and quality control.

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For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 THERMODYNAMICS AND STATISTICAL PHYSICS 2500
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 2500
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 2501
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 2503
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2503
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 2506
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2507
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2509
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 2509
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2510
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 2510

Note: N.A. means that no abstracts were assigned to this category for this issue.

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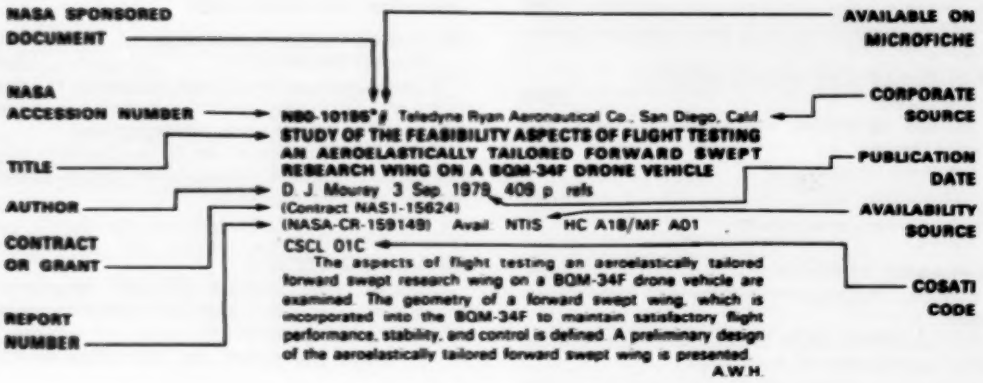
TYPICAL CITATION AND ABSTRACT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TITLE
STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE
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The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.
A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, NAVY VEHICLE DESIGN AND CONSTRUCTION - VORTEX/WING VISCOUS INTERACTION THEORY AND ANALYSIS

C.J. Dixon, Lockheed Georgia Co., *86 S. Cobb Dr., Marietta, Georgia* 30060 (DN475229; N00014-74-C-0151)

The objective is to expand the understanding and knowledge concerning the creation, development and stability of leading edge and other wing intersecting vortices, and to develop the analytical tools to explore these phenomena for the design of tactical aircraft wings, utilizing optimized wing-vortex interactions for improved aerodynamic efficiency.

The approach is to refine and improve the viscous numerical model developed under the conraact, and to use that model to investigate the effects of vortex formation, strength, position, growth or decay, and incipient burst, on the lifting-surface interacting vortex. Specific knowledge concerning the critical leading edge conditions and typical boundary conditions is to be obtained through wind tunnel tests and boundary-layer computations in the leading edge region. The viscous numerical model is being coupled with a potential flow model to provide complete aircraft forces and moments.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0002, INTEGRATED CONTROL SET

J. Whitton, General Electric Co., Aerospace Electronic Systems Division, *French Rd., Utica, New York* 13502 (DN081108; N62269-78-C-0375)

Current military aircraft cockpits abound with dedicated switches and controls which are used for a relatively short portion of the total mission. The numbers and locations of these dedicated switches and controls increase the pilots mission workload, clutter the cockpit instrument panel and foster errors and omission during phases of the mission in addition to increasing pilot training requirements. The integrated control set is designed to centralize the location of control switches, reduce the number of controls and switches needed and reduce pilot workload and training time.

Investigate the feasibility of using liquid crystal technology to fabricate the ICP. A number of switches shall have legends which are programmable according to mission phase. Switches will provide tactile and visual feedback and shall be readable in high ambient light level.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0003, QUIET PROPELLER CONCEPT EVALUATION

R.M. McGregor, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF451910)

The objective of this program is to evaluate the noise characteristics of various tail rotor configurations to determine the noise reduction potential of various new designs. Variables to be investigated include number of blades, blade to hub phasing angles and blade length.

This exploratory research program is divided into three phases as follows: Phase I - analytical prediction. This phase consists of the development of analytical techniques to predict the performance and acoustic characteristics of the various tail rotor configurations under consideration. The prediction programs will then be used to select the final test configurations. Phase II - experimental verification. This phase consists of the experimental verification of predicted performance and acoustic characteristics utilizing the propeller acoustics static test facility. Static performance and near-field acoustic data will be acquired for representative configurations. Phase III - correlation. This phase consists of a comparison of the results acquired during Phases I and II, modification of the prediction methods developed during Phase I where necessary and development of design procedures for reducing propeller and rotor noise.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0004, EMPIRICAL REPRESENTATION OF PARAMETRIC TURBINE ENGINE PERFORMANCE

J.R. Ruble, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF457530)

This effort will attempt to develop and/or modify multi-dimensional empirical procedures to represent engine performance (thrust, airflow, fuel flow) for a matrix of engine designs. Independent or input parameters to be examined will include bypass ratio, fan pressure ratio, overall pressure ratio, altitude, Mach number and power setting.

Currently, multi-dimensional empirical procedures are being developed by aircraft manufacturers to represent complex functions of several independent airframe parameters (wing loading, aspect ratio, sweep, thrust loading, etc) for some desired dependent parameter (takeoff gross weight, range, combat performance, etc). The need for this type of development is to reduce the amount of computer time required to evaluate preliminary aircraft system performance as a function of several (8 to 17) variables. The empirical procedures, when properly applied, can reduce preliminary design computer run time by an order of magnitude. In this effort, these procedures, or modifications of them, will be examined to determine if engine performance data can be represented empirically.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0005, HALON 1301 FIRE EXTINGUISHER SYSTEMS FOR AIRCRAFT DRY BAYS

C.L. Anderson, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143820)

This work unit will provide a technical data base to improve the vulnerability and survivability of aircraft in the combat environment. the major cause of aircraft combat losses is fuel system fire/explosion resulting from ballistic impact. Dry bays adjacent to aircraft fuel tanks are highly vulnerable to fires resulting from ballistic impact and are difficult to protect using current technology. The objective of this work unit will be to explore the use of halon 1301 fire extinguisher systems for protection against ballistically induced dry bay fires. Current tech-

nology is well developed for the use of halon 1301 fire extinguisher in well controlled situations such as engine nacelles. The use of halon 1301 extinguisher systems for ballistic protection is a natural extension of existing technology. However, the effects of ballistic impact performance is not fully understood and will require experimental investigation. The use of halon 1301 fire extinguisher systems for ballistic protection in dry bays will offer an attractive alternate protection concept to the aircraft designer. This type of system will be lighter in weight and will not have the environmental problems encountered with present state-of-the-art technology.

Evaluate present state-of-the-art technology for extinguisher system applications and choose a representative system/aircraft configuration to perform experimental/analytical investigations. Perform agent discharge tests to determine the effects of ballistic impact on extinguisher system performance. Perform high realism ballistic tests for proof of performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0006, INVESTIGATION OF SIDESTICK CONTROLLER DYNAMICS
G.T. Black, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144160)

The function or mission supported by this work unit is the updating of military flying quality requirements contained in MIL-F-8785B, specifically the development of flying qualities design criteria for sidestick-controller dynamics and sidestick-controlled aircraft. The problem area is optimally interfacing the pilot with the controller and aircraft for sidestick-controlled aircraft. The objective is to assemble a data base and to develop sidestick controller and sidestick-controlled aircraft criteria for use in the military flying qualities specification. The military relevancy is to improve the effectiveness of combat aircraft through better pilot/control-stick/aircraft interface characteristics.

The approach to be taken in fulfilling the objective is to assemble the available data base and prepare specification criteria based on these data for inclusion in the new MIL-PRIME-STD for flying qualities.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0007, SMALL SCALE MILITARY FLIGHT VEHICLE TECHNOLOGY
D.T. Lowe, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143010)

This effort supports development of advanced configurations of remotely-piloted vehicles (RPVs). Currently aerodynamic efficient drone vehicle designs which can be produced cheaply and are expendable do not exist. The objective of this effort is to develop and test the technologies to produce inexpensive, lightweight, small-scale drone vehicles. The configurations and subsystems developed in this effort will provide attractive low-cost options for carrier vehicles to conduct such military operations as defense suppression, target strike, ecm or reconnaissance.

Examine and adapt available hardware and concepts from small military drones. The major difficulties will be in achieving sufficient size reduction and low cost to meet cost and weight goals. The airframe design configurations will be proven by wind tunnel and flight testing. Low cost flight stabilization and control subsystems will be considered, as will radar cross-section and survivability. Developments from airframe and avionics contracts will be integrated into final designs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0008, WIND SHEAR SUPPORT PROGRAM
H. Wolowicz, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143470)

This work unit is the Air Force part of a joint USAF/FAA effort in wind shear research under interagency agreement DOT-FA70WAI-173, modification 16. This combination of resources allows both organizations to supplement each other by exploiting their special capabilities and expertise to address the wind shear problem. In recent years, wind shear has been identified as the probable cause of a number of civilian and military aircraft accidents in the landing and takeoff phases of flight. Data compiled by the Air Force inspection and safety center reveals that from 1965 through 1974, 41 probable shear/vortex related terminal area accidents cost the Air Force over 18 million dollars (multi-command ROC 501-76, "Low-altitude wind warning system"). Additionally, just as wind shear affects landings and takeoffs, it can also disrupt the accuracy of weapon delivery operations. Since the FAA has been designated as the lead agency for wind shear research, the Air Force will not develop a separate program, but will support the FAA through this cooperative effort. The objectives of this work unit are to develop, test and evaluate systems that provide to the flight crew, timely warnings of wind shear conditions, and to develop techniques for aircraft control through such conditions. The capability to reduce, or eliminate, the wind shear hazard to aircraft operations will increase the probability of successful mission accomplishment.

The Speckled Trout flight test aircraft will be used to test and demonstrate experimental wind shear systems. Present systems under development include wind shear sensors, displays, and telemetry systems to aid the aircrew during flight operations. Additionally, the test aircraft, with its inertial navigation and data acquisition systems, will be used to verify wind shear forecasts at selected locations. All testing will be done on a non-interfering basis and will be scheduled around the Speckled Trout operational commitments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, CHEMISORPTION AND CATALYSIS ON SOLID SURFACES USING MOLECULAR MANY-BODY TECHNIQUES
W.A. Goddard, California Inst. of Technology, Graduate School, Dept. of Chemistry & Chemical Engineering, *1201 E. California Blvd., Pasadena, California* 91109 (DMR74-04965 A03)

It is proposed to carry out quantum mechanical calculations of (1) the electronic states of surfaces, (2) of chemisorption of atoms and molecules onto surfaces, and (3) of the reactions of adsorbed atoms and molecules on surfaces (heterogeneous catalysis). This study will make use of the many-body quantum mechanical techniques developed and applied in the last two years to the study of the electronic states and reaction mechanisms of small molecules (O3, butadiene, etc.). Such techniques seem better geared to answering the important questions about chemisorption and catalysis than the more standard techniques of solid-state physics. The objective is to establish the basic mechanisms involved in chemisorption and heterogeneous catalysis and to develop computational techniques that can provide a detailed understanding of the fundamental processes.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0002, DYNAMICS AND INTERACTIONS IN CONDENSED SYSTEMS
J.P. McTague, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Chemistry, *405 Hilgard Ave., Los Angeles, California* 90024 (CHE76-21293 A03)

The structure, dynamics, interactions, and phase transitions in condensed phases and monolayer films will be investigated by three techniques: neutron and light scattering, and molecular dynamics simulation. Neutron scattering experiments on monolayer systems will explore the molecular structures, orientations, and phase transitions. Concomitant computer studies will attempt to ascertain the mechanisms of the two-dimensional phase transitions in these systems, as well as examining the details of

the process of freezing in three dimensions. A combined neutron and light scattering study will explore the dynamics of liquid N2. This work is a continuation of that currently supported by Foundation grant GP-40350X.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0003, REACTIONS OF METASTABLE ATOMS AND MOLECULES

E.E. Muschlitz, State University System of Florida, University of Florida, School of Arts & Sciences, Dept. of Chemistry, *208 Tigert Hall, Gainesville, Florida* 32601 (CHE76-17244 A03)

Dr. Muschlitz will continue experimental research on transfer of electronic excitation energy in molecular collisions using molecular beams, optical, and mass spectrometric techniques (currently supported by NSF Grant GP-30846X). In particular, more precise determination of the velocity dependence of absolute cross sections for Penning and association ionization will be made for reactions of state-selected beams of helium metastable atoms with various gases. New molecular beam investigations will be made of the velocity dependence of fluorescence following electronic energy transfer in collisions of metastable rare gas atoms. In particular, the vibrational energy distribution of product species will be determined by spectroscopic analysis of the emitted light. The results of these experiments would provide detailed answers concerning the mechanism of these bimolecular energy transfer processes which are of considerable importance in our understanding of upper atmosphere phenomena and the mechanism of laser action.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0004, ENVIRONMENTAL FATE OF HYDRAZINE FUELS

M.J. MacNaughton, U.S. Dept. of Defense, Air Force, Engineering & Services Center, Engineering & Services Lab., *Tyndall Air Force Base, Panama City, Florida* 32403 (DF408060)

Because of the increased use of the hydrazine family of compounds in rocket fuels and in monopropellent generators it is necessary to understand the chemistry of these compounds in the environment subsequent to their release by spills, venting or incomplete combustion. This data is necessary because of the toxic nature of these fuels and the requirement to assess the environmental effect of their use.

The time dependent fate of these fuels will be determined in the atmospheric, aquatic and terrestrial phases. The level of minor components which may be significant will also be determined. Infrared and mass spectral analysis will be used to determine reaction rates and decomposition products.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

3.0005, EXTENDED KOOPMANS' THEOREM AND ITS APPLICATION TO QUANTUM CHEMISTRY

D.W. Smith, University of Georgia, School of Liberal Arts, Dept. of Chemistry, *Athens, Georgia* 30601 (CHE75-02353 A02)

Dr. Smith intends to continue a program of research currently supported by Foundation grant, GP-34497X. Koopmans' Theorem in its original formulation states that in the independent particle scheme, the energy to remove an electron from an atom or molecule is equal to the energy of the orbital which the electron occupied. These energies must be calculated by the self-consistent-field method to be physically significant. Dr. Smith plans to investigate an extension of this theorem through calculations of ionization potentials and through development of the mathematical and conceptual basis of the extended theorem. While the original theorem has been widely used in chemistry and electron physics, and is so basic to chemical and physical thinking that it is implied in most discussions of electron loss, capture, and excitation, there are two major drawbacks to the use of the theorem. First, it assumes a self-consistent (independent-particle) approximation for the parent atom or molecule undergoing ionization, and therefore ignores correlation effects. Second, it does not allow for rearrangement of the other electrons when one is removed. His extended theorem corrects for these two deficiencies in such a way as to give extremely accurate predictions of valence electron ionization energies in preliminary studies so far, on 4-electron systems. He plans to study additional systems such as the Li and Ne atoms and the N2 molecule, and to investigate the properties of the new effective single-particle potential which comes out of the theory.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0006, A PROGRAM LEADING TO SPECIFICATIONS FOR AVIATION TURBINE FUEL PRODUCED FROM WHOLE CRUDE SHALE OIL

W.A. Sutton, Ashland Oil Inc., *1409 Winchester Ave., Ashland, Kentucky* 41101 (DF463890; F33615-78-C-2080)

The objectives of this program are to optimize new procedures for the efficient and economic processing of whole crude shale oil into high yields of military fuels while maximizing the yield of aviation turbine fuel and to determine the trade-offs between jet fuel yield, jet fuel properties, and processing costs.

The proposed program will be a 28 month effort incorporating all the following aspects, (1) process variable analysis, (2) analysis of laboratory samples, (3) production of component test samples, and (4) overall economic optimization by computer model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0007, ELECTRON TRANSPORT IN NONPOLAR FLUID

H.T. Davis, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Chemical Engineering, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (CHE78-08663)

This research is under the Structural Chemistry and Thermodynamics program, in the subarea of electronic processes in fluids. Professor Davis will undertake an experimental investigation of the drift velocity, diffusivity, attachment rates and dynamical instabilities of excess electrons in nonpolar fluids as a function of field, temperature, density and fluid composition. The object is to understand the fundamental nature of electronic processes in nonpolar fluids and to investigate the potential of such fluids for making devices such as chemical spectrometers (attachment rate studies) and as microwave amplifiers.

This research is a continuation of that currently supported by Foundation Grant, CHE-7402124.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0008, MATERIAL SUPPORT TECHNOLOGY - CORRELATION, DISORDER, AND NOISE IN ELECTRONIC SYSTEMS - METAL-INSULATOR TRANSITIONS IN SEMICONDUCTORS

D.C. Licciardello, Princeton University, Graduate School, *205 Nassau Hall, Princeton, New Jersey* 08540 (DN775758; N00014-77-C-0711)

The fundamental processes in non-crystalline systems determine the important electronic properties of a wide range of materials that are important for naval system applications, from glass to sophisticated electronic semiconducting devices. Unfortunately, many of these fundamental processes are not well understood. This program will address the electronic properties of these non-crystalline systems.

This program will carry out basic research into the electronic properties of disordered and non-crystalline systems. The underlying principles for understanding these phenomena have been exposed within the last twenty years or so, but only recently has the kind of quantitative progress been made that is necessary for a predictive science. In particular, this program will address the theoretical aspects of the interacting Fermi glass, power law localization phenomena, semiconductor-oxide-metal systems, and noise properties. The sophisticated tech-

niques of renormalization group theory and scaling will be employed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0009, MOLECULAR BEAM AND LASER-INDUCED FLUORESCENCE SPECTROSCOPY OF SMALL MOLECULES

J.S. Muenter, University of Rochester, School of Arts & Sciences, Dept. of Chemistry, *260 Crittenden Blvd., Rochester, New York* 14627 (CHE77-12527 A01)

Using the techniques of molecular beam electric resonance spectroscopy and laser-induced fluorescence spectroscopy, Prof. Muenter will study electronic properties of a variety of small molecules. The molecular beam methods will be used to accurately measure dipole moments, polarizabilities, and nuclear hyperfine parameters of the ground electronic state of molecules. The molecules which will be studied have been chosen because of unusual chemical characteristics and in general contain fluorine, chlorine, and/or nitrogen atoms. A major goal in these studies will be obtaining information which better defines the intermolecular interactions of the molecules in question.

The laser-induced fluorescence experiments will be directed toward extending high-resolution measurements, which have been routine for the electronic ground state of molecules, to excited electronic states. Wavelength tunable dye lasers will be used to excite molecules to upper electronic levels where radio frequency and microwave transitions will be studied. The high-resolution transitions will be detected by observing the excited electronic state fluorescence. The molecular properties obtained in these experiments will provide important parameters which characterize photochemically active molecules. This research represents a continuation of that currently supported by Foundation grant CHE-7412250.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0010, GRAIN BOUNDARY PINNING OF FLUX LINES IN NIOBIUM BICRYSTALS

Y.T. Chou, Lehigh University, School of Engineering & Physical Science, Dept. of Metallurgy & Materials Science, *Alumni Memorial Bldg., Bethlehem, Pennsylvania* 18015 (DMR79-15799)

This is a fundamental study of grain boundary flux pinning in niobium bicrystals. Oriented bicrystals will be grown directly from the melt, and the segregation of impurities of the grain boundary will be determined by Auger analysis. The bicrystals will be used as a model material to measure resistive current as a function of the applied magnetic field and the angle between the field and the grain boundary. The critical current measurements will be done at the Oak Ridge National Laboratory, in collaboration with Dr. DasGupta.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0011, A PROGRAM LEADING TO SPECIFICATIONS FOR AVIATION TURBINE FUEL PRODUCED FROM WHOLE CRUDE SHALE OIL

A. Schneider, Suntech Inc., *P.O. Box 1135, Marcus Hook, Pennsylvania* 19061 (DF462710; F33615-78-C-2024)

The objectives of this program are: (1) To optimize new procedures for the efficient and economic processing of whole crude shale oil into high yields of military fuels while maximizing the yield of aviation turbine fuel. (2) To determine the trade-offs between jet fuel yield, jet fuel properties and processing costs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0012, RESEARCH INITIATION - SURFACE EFFECTS ON THE MECHANICAL BEHAVIOR OF TITANIUM

E.I. Savage, University of Rhode Island, Graduate School, *Green Hall, Kingston, Rhode Island* 02881 (DMR78-05427)

The objective of this investigation is to examine in detail some previously observed effects relating surface condition to the bulk mechanical properties of titanium. The effects observed included a drop in flow stress or increase in creep rate in proportion to the applied current for commercial purity polycrystalline titanium undergoing anodic dissolution in an acidic solution. Stress relaxation experiments will be undertaken as a function of purity level, surface cleanliness, and stress reversal. The results obtained are expected to contribute toward understanding stress corrosion cracking processes in metallic materials.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0013, LASER SPECTROSCOPY OF IONS IN THE GAS PHASE

M.L. Vestal, University of Houston, School of Natural Sciences & Mathematics, Dept. of Chemistry, *3801 Cullen Blvd., Houston, Texas* 77004 (D-693)

The tandem quadrupole mass spectrometer has been mated with a new laser system consisting of a tunable dye laser pumped by a 400 KW pulsed nitrogen laser. This laser system provides continuous coverage of the spectrum from 360 to 750 nm with a bandwidth of 0.4/cm. Experimental measurements of photodissociation cross sections for the rare gas dimer ions such as Ar2 plus and Ne2 plus are currently in progress. In addition to spectroscopic investigations on the electronically excited states of ions, the present studies should provide data on collisional relaxation of specific vibrational levels of the ground electronic state. The instrument has recently been modified to allow investigations of laser photodetachment of negative ions as well as the photodissociation measurements conducted previously. This new capability is presently being applied to studies on competitive autodetachment and predissociation of laser excited CO3 ions formed in CO2 and CO2/O2 mixtures.

SUPPORTED BY Robert A. Welch Foundation

3.0014, SYNTHESIS AND OPTICAL STUDIES OF CLUSTERS AND SOLIDS EXHIBITING COOPERATIVE PHENOMENA

G.A. Crosby, Washington State University, School of Arts & Sciences, Dept. of Chemistry, *Administration Bldg., Room 101, Pullman, Washington* 99163 (DMR78-10008)

In recent years, there has been a surge of interest in the cooperative interactions between paramagnetic transition-metal ions coupled in clusters and coupled in chains, layers, and three-dimensional solids. These interactions, classified as exchange or superexchange, are of paramount interest because of their manifestations as agents of magnetic ordering. In Professor Crosby's laboratory, optical investigations of compounds displaying these cooperative phenomena are carried out. These compounds include binuclear complexes of chromium(III) containing organic ligands, binuclear species of chromium, molybdenum and tungsten bridged by halide ligands, and simple bridged structures containing group (VIII) elements. The immediate goal of the research is to investigate both the ground and excited electronic terms of a few systems in order to obtain, by direct optical techniques, information on coupling schemes and selection rules. The long-range goal of the research is to generate new classes of compounds, mainly of the second and third row transition elements, that will display potentially interesting and useful magnetic and electronic properties.

This is a continuation of work supported by DMR 74-14443. It is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0015, STATIC CHARGE GENERATION ASSOCIATED WITH PLASTIC FOAM AND SURFACE COATING MATERIALS IN AIRCRAFT FUEL TANKS
A.W. Bright, University of Southampton, *Southampton, England, United Kingdom* (DF461770; AFOSR-77-3373)

Investigate the electrostatic phenomena arising from use of reticulated polyurethane foams, surface coatings, and bladder cells in aircraft fuel tanks, and the effect of fuel electrical conductivity upon the charge generation rate.

Determine the dielectric properties of various aircraft fuel tank components such as foams, coatings, and fuel cell elastomers. Study charge relaxation of fuel tank materials. Conduct part-scale and full-scale tests to determine electrostatic behavior of foams, coatings, and fuel cell materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, C-141 RELIABILITY CRITERIA MAINTENANCE
N. Singpurwalla, Southeastern Center for Electrical Engineering Education Inc, *Auburn, Alabama* 36830 (DF918890; F30602-78-C-0148)

Contractual support on this project will involve analyses of selected criteria variables in order to detect changes in location of measures of central tendency due to RCM (reliability centered maintenance) treatment. Such analyses will primarily involve time series techniques which will require review of data, identification and evaluation of candidate time series models, and discussion on the relative merits of each model proposed. Required data processing support will be provided by the AFLMC (Air Force Logistics Management Center) to include box Jenkins techniques.

Contractual support will also involve review of supporting documentation concerning the USAF RCM program (to be provided by the AFLMC), comparison of the USAF RCM concept with concepts embraced by commercial airlines, and constructive criticism as to how USAF RCM concepts might be enhanced to improve fleet availability or reduce fleet maintenance costs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0002, HIGH LOAD CAPACITY FOIL BEARING DEVELOPMENT
Unknown, Signal Co. Inc., Airesearch Manufacturing Company, *402 S. 36th St., Phoenix, Arizona* 85034 (DF463550)

To increase the load carrying capability of gas lubricated foil bearings, with primary emphasis on the journal bearing, in order to meet the maneuver load requirements of MIL-E-5007D.

(1) Use existing foil bearing analytical capability to optimize advanced foil bearing designs, (2) evaluate advanced designs in modified test rigs which eliminated rotor dynamics problems, (3) correlate experimental results with analytical predictions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0003, VPE GROWTH III-V STRUCTURES
G. Stringfellow, Hewlett Packard Co., *1501 Page Mill Rd., Palo Alto, California* 94304 (DF903150; F19628-77-C-0199)

AF function - integrated optics for communications systems. Deficiency or opportunity - GaAs-AlGaAs epitaxial structures for integrated optics devices are being grown exclusively by liquid phase epitaxial techniques. Problems involving consistent surface morphology, and reproducibility have slowed progress, and scaling up has not been demonstrated. How research contributes - vapor phase epitaxial processes have demonstrated an ability to produce layers with superior morphology and in the case of LED production have been scaled successfully. The ability to deposit AlGaAs and high purity GaAs layers by using organometallics in a vapor phase system has been shown. Successful application of this technique to the fabrication of integrated optics devices could eliminate the present deficiencies of liquid phase preparation techniques.

A vapor phase deposition process using organometallic compounds will be investigated, studied, and developed to produce GaAs-AlGaAs device structures for use as components in integrated optics systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0004, INFRARED AND OPTICAL MICROSCOPY EMPLOYING NONLINEAR OPTICAL TECHNIQUES
R.W. Hellwarth, University of Southern California, School of Engineering, Dept. of Electrical Engineering, *3551 University Ave., Los Angeles, California* 90007 (ENG78-04774)

The objective of this project is to explore and expand the use of nonlinear optics in microscopy. Means are being sought to make visible microstructures, such as domains and inclusions in materials, which are not visible to other microscopes. The most exciting new techniques being explored are those based on a discovery that a time-reversed replica of a monochromatic image can be generated utilizing the inherent nonlinear refraction that is present in all materials. These techniques, which fall into three classes, are used to image: (1) The structure in the nonlinear refractive index in classes of materials, (2) Regions in which the linear refractive index is not the same for the forward and reversed waves, and (3) Spatial changes in birefringence of materials.

Resonant enhancement, and the experimental means of implementing the replication process are being investigated. This research is important not only to microscopy but to signal and image processing as well.

This research was previously supported under NSF Grant ENG75-19335.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0005, LARGE APERTURE SYSTEM APPLICATIONS
F. Ayer, Charles Stark Draper Lab. Inc., *68 Albany St., Cambridge, Massachusetts* 02139 (DF911430; F30602-78-C-0128)

The objective of this effort is to assess active control concepts for disturbance suppression and performance enhancement of large aperture, ultra light weight space radar antennas. Also to develop design criteria for improved performance of such antennas with and without active control.

Active control approaches shall be analytically investigated for distortion suppression of modeled disturbance characteristic of large aperture, ultra light weighted radar antennas for space applications. Mechanical/electrical implementations shall be assessed for both reflective and phased array antennas. Performance benefits shall be contrasted against passive distortion suppression approaches.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0006, HETEROSTRUCTURE NEAR-INFRARED DETECTORS, LIGHT EMITTERS AND PHOTOCATHODES
C.G. Fonstad, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering & Computer Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (ENG76-09586)

A study of a quaternary system composed of aluminum, gallium, arsenic and antimony for application in heterostructure geometry, near-infrared detectors, emitters, and photocathodes will be made. The use of a quaternary is necessary to avoid lattice mismatch dislocations in heterostructure devices. Reduced junction recombination, laser thresholds, and leakage in detectors and photocathodes, and increased radiative efficiency and operating lifetimes of high intensity sources are possible. Liquid phase epitaxy will be used to thoroughly characterize the growth, lattice constant, and energy gap of this quaternary. The

program will emphasize applications to heterostructure laser diodes for use in fiber-based optical communication systems. The use of silicon doping in the active region is an important and, for this alloy system, a unique feature of this program.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0007, HIGH ENERGY DENSITY PHOTOVOLTAIC CONVERTERS

D.H. Navon, University of Massachusetts, Amherst Campus, School of Engineering, Dept. of Electrical Engineering, *Amherst, Massachusetts* 01002 (ENG76-80145)

An investigation will be initiated into the optimum designs of semiconductor photovoltaic converters under high energy density irradiation conditions. The work is motivated by interest in collection systems that use mirrors and lenses to focus the incident solar energy onto relatively small solar cell devices. The research will be directed toward calculating the current density and temperature distributions in a two-dimensional model of a semiconductor photovoltaic cell, as well as the power output under intense illumination. Due to the highly nonlinear nature of the electrical carrier flow and heat flow equations describing the device operation, a difference equation computer analysis of the problem will be employed. This will facilitate investigation of a variety of device structures incorporating heterotaxial layers, arbitrary impurity distributions, different electrode configurations, unusual cell geometries, etc. Effects such as the impurity concentration, temperature, and field dependence of the carrier mobilities, the temperature dependence of the thermal conductivity, the various surface and bulk recombination mechanisms, etc., will be included in this computer-aided two-dimensional, high current density level, nonisothermal model.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0008, MEASUREMENT OF THREE-DIMENSIONAL TEMPERATURE FIELDS BY HOLOGRAPHIC INTERFEROMETRY

C.M. Vest, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Mechanical Engineering, *Ann Arbor, Michigan* 48104 (ENG76-24121)

Multidirectional holographic interferometry will be developed for application to measurement of three dimensional, asymmetric temperature field in fluids, and will be applied to the study of thermal plumes. Emphasis will be on improvement of attainable accuracy and alleviation of experimental difficulties due to refraction and opaque objects in the test section. Experimental accuracy will be improved by developing a holographic interferometer in which phase shifts are measured with high precision by electronic means. The accuracy with which temperature fields are computed from interferometric data will be improved by a direct three-dimensional reconstruction method that more fully utilizes the data available in a multidirectional interferogram. A method for using holographic interferometry to measure temperature fields that significantly refract probing optical rays will be developed. Methods for reconstructing temperature fields when an opaque object blocks a portion of the probing optical rays will be developed. The use of fringe localization measurement in analysis of interferograms will be explored. The technique developed during this program will be used to study the interaction of thermal plumes above multiple sources, and natural convection above surfaces of arbitrary platforms. The feasibility of determining the spatial distribution of temperature in turbulent plumes will be assessed.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0009, MEASUREMENTS OF OH FLUOROESCENCE AND ABSORPTION USING A TUNABLE DYE LASER

C.C. Wang, Wayne State University, School of Engineering, Dept. of Electrical & Computer Engineering, *5950 Cass Ave., Detroit, Michigan* 48202 (ENG77-26618)

Theoretical and experimental studies are being conducted to assess the feasibility of using a tunable dye laser and the technique of resonance absorption to determine the temperature and the OH concentration in combustion media. In particular, efforts are being made to determine: (1) the conditions under which the population distribution among high-lying rotational levels can be used for estimating the temperature of the medium; (2) the pressure and temperature range over which the translational temperature of OH can be deduced from the linewidth of the absorption transitions of OH; and (3) the nature of such physical phenomena as the saturation of the absorption transition and their effect on the results of measurements.

The fluorescence technique for temperature determination in a combustion medium is also being studied. Particular attention is being given to the pressure and temperature dependence of such parameters as linewidth of the absorption transition and quenching of the excited OH. In addition, interference effects due to fluorescence and spontaneous Raman emission of other molecular species present in the medium are being considered. A dye laser system consisting of the two independently tunable lasers is being set up in order to measure the relative absorption of two different rotational levels and to thereby determine rotational temperatures.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0010, FLICKER NOISE IN SEMICONDUCTOR DEVICES

A. van der Ziel, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Electrical Engineering, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (ENG78-25426)

The low frequency noise properties of semiconductor devices are being examined from both theoretical and experimental points of view. Interest is centered on developing a comprehensive model to characterize flicker noise and to resolve questions concerning the noise source. These questions deal with carrier density and mobility fluctuation contributions to the noise and with the relation of these effects to such phenomena as trapping and detrapping of carriers in oxide-semiconductor interface states. Experiments are performed in semiconductor diodes that are subjected to diffusion and related surface treatments and are operated under varying conditions of surface inversion. Measurements on thermoelectric and Hall effect devices are also being performed and correlated with theory.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0011, STOCHASTIC METHODS IN WIND-STRUCTURE INTERACTION

M. Shinozuka, Columbia University, School of Engineering & Applied Science, Dept. of Civil Engineering & Engineering Mechanics, *Broadway & W. 116th St., New York, New York* 10027 (ENG76-12257)

The specific objectives and methodologies are twofold. Mathematical Modeling of Wind-Structure Interaction - since most civil engineering structures are not well streamlined and since the incoming flow can be highly turbulent the existing aerodynamic theories under the conditions of steady fluid do not adequately describe the wind-structure interaction. Therefore, it is intended to utilize the existing theory of nonsteady aerodynamics of bluff bodies in a turbulent flow as well as the random process theory to establish an analytical model between wind velocity and wind forces for a variety of structures of practical importance. Then, utilizing the existing experimental observation from full scale measurements and wind tunnel testing, the validity and the necessary modifications of the analytical wind-structure interaction models will be established. Identification of Structural-Aerodynamic Systems - recently some effort has been made to identify structural dynamic parameters such as damping and natural frequencies from measurements of structural response under ambient excitation. However, it is of equal importance to identify the self-excited and buffeting aerodynamic wind loads acting on the structure. The time-domain procedure to be developed will provide a simple and relatively inexpensive alternative for identifying the characteristics of in-

teracting wind-structure systems since it only requires the measurements of input and output or sometimes output data alone. Specifically, the objectives here are to explicitly identify all structural and aerodynamic parameters involved in the equation of motion of the interacting system from observed time histories of (wind velocity) input and (deformation) response output.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0012, ACTIVE CONTROL SYSTEMS FOR CIVIL ENGINEERING STRUCTURES

T.T. Soong, State University of New York, Buffalo Campus, School of Engineering & Applied Science, Dept. of Civil Engineering, *3435 Main St., Buffalo, New York* 14214 (ENG76-82226 A01)

This grant provides the second year of funding for theoretical research previously described under NSF/ENG-76-82226. Additionally, it incorporates limited experimental work using two five foot aerodynamic models in a wind tunnel to verify the potential of active surfaces for dissipation of unwanted kinetic energy in structures.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0013, TURBINE ENGINE EXHAUST NOZZLE PERFORMANCE INVESTIGATION

D.A. Dusa, General Electric Co., *1 Jimson Rd., Cincinnati, Ohio* 45215 (DF455850; F33615-73-C-2037)

The objective of this program is to assess the potential for use of various plug nozzle types in advanced integrated propulsion systems of the future. In particular, the contractor will define external and internal flow characteristics and performance of promising plug nozzle designs installed in afterbodies of advanced design.

Phase I, design studies of various plug nozzle types and afterbody shapes for use in advanced technology engines. Phase II, fabrication and testing of the most promising of these configurations. Phase III, definition of follow-on full simulation testing program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0014, TF 34 ENGINE TEST

L. Colemerrill, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF462080)

To provide definition and assessment of performance, functional, and life characteristics of the TF34 model engine.

Conduct a series of sea level static tests in the AFAPL facilities to acquire and analyze performance, functional and life data of the TF34 engine and submit appropriate recommendations regarding current problem solutions and improvements. The first test (Phase I) will consist of an engine/facility checkout program for personnel familiarization and confirmation of installation, instrumentation and operation aspects. Phase II will consist of a series of cyclic endurance tests.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0015, CRF FLOW QUALITY INVESTIGATION

R. Rivir, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF460540)

The primary objectives of this program are to determine the steady-state and dynamic distortion levels within the test chamber and the compressor bell-mouth of the compressor research facility (CRF) and to develop techniques to reduce these levels to acceptable values.

A series of tests are being carried out on a one-tenth scale model of the crf using global mach number scaling with flow control elements employing Reynolds number similarity. Current and planned distortion tests involve parameters such as pressure, temperature, velocity, and flow direction.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0016, APPLIED NONLINEAR INTERACTIONS IN GASES AND PLASMAS

P.W. Schreiber, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF458810)

AF function - laser development, combustion studies, compressor studies, chemical emissions, aerodynamic testing. Deficiency - on-site methods are needed to determine temporarily and spatially resolved species concentrations in reacting and nonreacting flows. Research -development of an experimental and theoretical base for the applications of nonlinear and linear spectroscopy to the measurement of species concentrations, temperature and velocity in plasma and gases. How research contributes- recent experimental and theoretical studies in nonlinear optics indicate that these effects may provide powerful new methods to measure spatially and temporally resolved temperature, species concentrations, and velocity in laser and combustion media. These effects will be explored analytically and experimentally for potential applications to current Air Force problems. Where applicable, programs will be initiated to develop the required optical systems for the evaluation of the new techniques.

Nonlinear effects such as stimulated Raman scattering (SRS), stimulated Brillouin scattering (SBS), and coherent anti-Stokes Raman scattering (CARS) have been generated in the laboratory in gases. In particular, CARS has been observed at low pressures for a large number of molecules. These effects will be evaluated analytically and experimentally as potential methods to measure temporally and spatially resolved temperature, velocity and number density distributions in combustion laser, and gas dynamic systems of interest to the Air Force. Special emphasis will be placed on the evaluation and interpretation of experimental data realistic environments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0017, INVESTIGATION OF METHODS OF PLASMA EXCITATION

M. Lake, Universal Energy Systems Inc., *Dayton, Ohio* (DF461390; F33615-77-C-3113)

AF function - communication, illumination, weaponry. Deficiency -lack of data on efficient methods of plasma excitation and of microscopic excitation processes. Research - experimental analysis of excitation methods and cross sections. How research contributes -provides total ionization cross sections and excited state cross sections in both atomic and molecular gases. Microwave excitation provides efficient distributed discharge excitation.

The research will be conducted using three existing experimental configurations located in Bldg 450, WPAFB. They are a cross-beam excitation analyzer (2xB), a fast Fourier transform (FFT) facility and a microwave excitation facility.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0018, PRESTON TUBE RESPONSE IN TRANSONIC FLOWS

W.G. Tiederman, Oklahoma State University, Agricultural Experiment Station, Dept. of Mechanical & Aerospace Engineering, *107 Whitehurst Hall, Stillwater, Oklahoma* 74075

Modifications were made to the boundary layer computer program so that it could simulate the response of a Preston tube as the tube is traversed from the laminar to the fully turbulent portion of a boundary layer.

SUPPORTED BY Oklahoma State Government

4.0019, MATERIALS RESEARCH L/ BORATORY
G.S. Heller, Brown University, Graduate School, Dept. of Engineering, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DMR76-80560 A01)

Partial research support is provided for 36 faculty from the Departments of Physics, Chemistry, Applied Mathematics, and Geological Sciences and from the Division of Engineering. Major interdisciplinary research programs are carried out in the following four areas: (1) Microscopic and Macroscopic Dynamic Plasticity; (2) Fracture of Solids -atomistic, microstructural, and continuum; (3) Inorganic Glasses -ionic oxides, semiconductors, and metallic alloys; (4) Chemisorption and Related Surface Interactions.

Minor programs are also carried out on the Low Temperature Properties of Materials and on the Synthesis and Properties of Pseudo-One-Dimensional Conductors.

Support is also provided for the operation and maintenance of nine central experimental facilities, with particular emphasis on materials synthesis, mechanical testing, and optical properties measurement.

This award is a continuation of Grant DMR76-00890.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

4.0020, LARGE DEFLECTIONS OF DYNAMICALLY LOADED STRUCTURES WITH PLASTIC AND VISCOPLASTIC MATERIAL BEHAVIOR
P.S. Symonds, Brown University, Graduate School, Dept. of Engineering, *University Hall, Box 1883, Providence, Rhode Island* 02912 (ENG77-11874)

This continues research begun under NSF/ENG74-21258 and is aimed at providing techniques for estimating large deformations of engineering structures caused by high intensity pressure pulses or by impact. Strain rate sensitive plastic flow will be taken as the primary feature of inelastic behavior (in mild steel and titanium, for example), and the techniques to be investigated assume constitutive laws of homogeneous viscous type with constants derived from stress-strain data at elevated strain rates. These constants will be adjusted to correspond to changing levels of strain and strain rate in the structure. Based on these constitutive equations, two techniques of approximation will be investigated, namely, a deflection bound method, and the 'mode approximation' technique. The former furnishes an upper bound on the final deflection at any point of the structure in terms of the initial kinetic energy and on the response time. The latter provides an approximate solution for particular initial velocity conditions from any full solution of the field equations, the simplest such solution being one in modal form, i.e., a product of a time function and a function of space variables. The extension to large deflections with viscoplastic behavior will be investigated by use of the concept of instantaneous mode solutions. These satisfy the field equations at large deflections with the deflection slope field treated as known and fixed at a given instant. The unknown deflection may be obtained by an iterative scheme or a direct calculation, the shape and acceleration constituting a nonlinear eigen-problem. The computations required for the deflection bound, which have been found to be analogous to those which determine the instantaneous mode, will be further clarified and generalized.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0021, IAP SURFACE GEOMETRY GENERATION
R. Robertson, Atlantic Research Corp., *5390 Cherokee Ave., Alexandria, Virginia* 22314 (DF737690; F30602-77-C-0126)

The objective of this effort is to develop the algorithms and computer codes to generate within the computer the description of a given geometrical surface to be used as an input for the RADC electromagnetic compatibility analysis codes. Examples of such surfaces include aircraft fuselages, wings and ground-based antenna towers.

The contractor will determine the geometry inputs required by the analysis codes now existing or planned within the framework of the intrasystem compatibility analysis program (ICAP), such as the intrasystem electromagnetic compatibility analysis program (IEMCAP) and the general electromagnetic model for the analysis of complex systems (GEMACS). Based on the requirements determined from this evaluation the contractor will develop the algorithms and a computer code for a geometry generation module (GGM) that shall interface with the ICAP codes. This will enable the user to enter a physical description of the system geometry into the required solution technique to the degree of accuracy required. Candidate techniques that can be used to generate the surface geometry include generic elements (cylinders, cones, spheres, etc.) and spline function descriptors. The end item is a computer code and its documentation which can be used in a stand-alone mode or in concert with ICAP codes to mathematically model a physical system as a combination of surfaces.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0022, COMPATIBLE MILITARY/COMMERCIAL AIRCRAFT MULTIPLEX DATA BUS SYSTEM
M.D. Schule, Boeing Co., Boeing Aerospace, *7555 E. Marginal Way S., Seattle, Washington* 98124 (DN081137; N62269-79-C-0339)

The objective of this task is to generate and provide the required documentation which will allow the Navy to propose a multiplex data BUS structure which can be accepted by both the military and commercial avionics and aircraft industry for implementation within military and commercial aircraft. This contracted effort supports work unit ZC101, Agency Accession Number CN 081123.

This effort is to be accomplished within the context of existing tri-service MIL-STD-1553B and commercial ARNIC data BUS standards and specification. Additionally, work is to be performed within the framework of existing tri-service and industry multiplex data bus organizations and committees who have extensive experience and background in the area of data BUS standards, technology, and implementation.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Communication Navigation Tech Directorate

4.0023, PULSE PROPAGATION AND SCATTERING IN RANDOM MEDIA
A. Ishimaru, University of Washington, School of Engineering, Dept. of Electrical Engineering, *206 Guggenheim Hall, Seattle, Washington* 98105 (ENG77-12544)

This program is concerned with propagation and scattering characteristics of a short pulse in a random medium and the effect of transmission medium inhomogeneities on wave fluctuations. The study will concentrate on the following specific topics: (a) Pulse scattering from a dense random medium and image resolution. This includes studies on coherence time, coherence bandwidth, the effects of particle size and velocity distributions, backscattering and bistatic scattering from turbulence and particles, range and lateral resolutions and the effect of the imaging system. (b) Effects of inhomogeneities. This involves study of the effect of ray-bending and shrinkage of the Fresnel size on wave fluctuation characteristics, and extension of the analysis to the strong fluctuation case and to thin screen theory. The above studies will be conducted with a view towards optical, acoustic and microwave applications in communications, remote-sensing, detection, and imaging problems. Some ultrasound and optical experiments will be conducted to verify theoretical predictions.

This is a continuation of research previously supported under NSF grant ENG-7423540.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0024, LOW FREQUENCY POLAR REFLECTIVITY
N.V. Jensen, Danske Meteorologiske Institut, *Lyngby, Denmark* (DF904350; AFOSR-78-3545)

AF function - navigation and survivable communications. Deficiency - communication interference from natural and nu-

clear ionospheric disturbances. Objective - employ high resolution techniques to measure arctic propagation stability under normal and disturbed ionospheric conditions. How research contributes - provides the experimental information required for interpreting and modeling VLF/LF propagation.

The propagation reliability of these frequencies is based on theoretical modeling for which there is only limited quantitative data, particularly for disturbed conditions. As the lower ionosphere is severely disturbed during polar cap absorption events which occur occasionally at high latitudes, a unique opportunity is provided to investigate propagation effects. To observe this phenomenon, AFGL'S VLF/LF ionosounder was moved to Greenland with the transmitter at Thule Air Base and the receiver at the Danish Meteorological Institute's ionospheric observatory in Qanaq, Greenland. Through this research grant the receiver will be installed and operated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, MODULATION PHASE AND FARADAY ROTATION OBSERVATIONS OF ATS-6 SATELLITE RADIO BEACON TRANSMISSION AT COLLEGE, ALASKA

R.D. Hunsucker, University of Alaska, College Campus, Geophysical Inst., *Bunnel Memorial Bldg., College, Alaska* 99735 (ATM77-23433)

This grant funds the deployment of a 140 and 360 MHz Polarimeter receiver to measure modulation phase and Faraday rotation of the ATS-6 satellite radio beacon experiment transmission on the ATS-6 ray path to Fairbanks, Alaska.

Geosynchronous satellites allow ionospheric and plasmaspheric plasma content measurements to be made by the use of relatively simple and reliable ground based receivers. Combining two techniques (modulation phase and Faraday rotation) one can in principle sort out the near (F region) plasma content from the distant (plasmaspheric) portion along a total line of sight charged particle content. In practice this is done with accuracy inadequate to many purposes of interest unless additional information is available on the altitude distribution of the F region plasma. The receiver to be employed in the work funded here is at a location where the incoherent scatter radar (Chatanika) will provide this information, thereby allowing meaningful interpretation of the satellite transmission data received. The derived plasmaspheric electron contents are at a sufficiently high latitude that they are unique for plasmaspheric dynamical studies; the uniqueness is by virtue of the proximity to that latitude at which the very sharp plasmaspheric boundary is found to sensitively respond to geomagnetic events. One important question the data should address is whether the shrinkage of the plasmasphere during magnetospherically disturbed periods results from 'peeling away' of outer shells or an inward compression of the plasma into the ionosphere.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0002, AURORAL HIGH LATITUDE MORPHOLOGY AND DYNAMICS

S. Akasofu, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (DF582490; F19628-79-C-0067)

AF function - transpolar communications, radar and navigation. Deficiency - the polar ionosphere is presently very unpredictable to such a degree that the above functions are frequently degraded or crippled. Objective - investigate the phenomenology of the arctic ionosphere to provide a capability for the prediction of the onset and intensity of ionospheric substorms. How research contributes - provides for the interpretation of data in terms of magnetospheric phenomenology and theory as a basis for the prediction of the onset and severity of magnetospheric substorms and warning of disturbances in support of AF systems. This effort provides inputs to in-house research for modelling effects of particle precipitation on arctic ionosphere. Investigates the phenomenology of arctic precipitation through the collection and analysis of data to provide a framework for the interpretation of data collected by AFGL airborne ionospheric observatory, NKC-135 aircraft, number 53131 and the AFGL Goose Bay ionospheric observatory.

Process and maintain aircraft and ground station all-sky camera data. Gather and interpret ionospheric and magnetospheric data for selected periods in support of special studies. Investigate ionospheric response during a magnetospheric substorm. Clarify relationship between discrete and continuous aurora using DMSP data. Study the interaction of the interplanetary magnetic field with the geomagnetic field in relation to magnetospheric substorms. Evaluate and develop techniques for predicting magnetospheric substorms.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0003, CHARGED-PARTICLE BEAM INJECTION STUDIES

Unknown, Jaycor, *1401 Camino Del Mar, Del Mar, California* 92014 (DF583530; F19628-79-C-0121)

AF function - satellite survivability and communications. Deficiency - the space-environmental effects of beam injection experiments are not fully understood. Objective - to gain an understanding of the effects on the vehicle and ambient plasma of charged-particle beam injection from a vehicle and the characteristics of the beam in the vicinity of the vehicle. How research contributes -will provide a basis for assessing the effect of charged-particle beam injection into the ionosphere.

Pertinent theory and experiments in the literature will be studied. Effects of charged particle injection in the ionosphere in the vicinity of the vehicle will be calculated. These will include the steady-state and time-dependent vehicle potential, the charge-current emission limitations, secondary electron and ion effects, and the energy spectrum of the beam leaving the vicinity of the vehicle.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0004, ACTIVE AND PASSIVE MAGNETOSPHERIC PROBING AT VLF - A PROGRAM OF DATA ANALYSIS AND DATA ACQUISITION

R.A. Helliwell, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (ATM78-05746)

This award supports a grant for very low-frequency (VLF) research on the properties of the earth's magnetized plasma envelope or magnetosphere. The program has two major components: (1) data acquisition at Roberval, Quebec, Canada, with emphasis on the reception of signals from an experimental VLF transmitter located at Siple Station, Antarctica, and (2) analysis from both active and passive probing experiments. The passive experiments will include coordinated international observing campaigns, direction finding compaigns, and multi-technique observations from a single location. The program is aimed at gaining understanding of wave particle interaction in the magnetosphere and of the distribution and dynamic behavior of the 'cool' background component of the magnetospheric plasma. The importance of these studies lies in the fact that the magnetosphere plays an important role in transmitting energy from the sun to the earth. Wave particle interactions within the magnetosphere are believed to be important factors in the process of energy storage and flow within the magnetosphere. Furthermore, the particular ways in which these processes occur in the middle atmosphere may reveal fundamental properties about magnetized collisionless plasmas as they exist elsewhere in the universe.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0005, AUTOMATIC WEATHER STATIONS FOR ANTARCTIC METEOROLOGICAL RESEARCH
A.M. Peterson, Stanford University, Stanford Electronics Lab., *Stanford, California* 94305 (DPP78-00548)

Twenty automatic weather stations (AWS) will be constructed in 1978 and 1979 for use in Antarctica. During austral summer of 1978/79, three of these AWS will be installed between Dome C and Dumont d'Urville for a study of katabatic winds; four AWS will be installed near McMurdo Station for use in a mesoscale meteorology research project; and one AWS will be installed at Siple Station for field testing in heavy snow environment. During austral summer 1979/80, the remaining twelve AWS units will be installed in data-sparse regions along the Weddell Sea coast, the Bellingshausen Sea coast, and the Amundsen Sea coast. During austral summer 1980/81, the AWS units used in the katabatic wind study will be redeployed to the Dry Valleys area near McMurdo for a study of the climatology of that region. During the second through the fourth years of this project, the deployed AWS units will be visited annually for servicing and repair. The data collected by these AWS will be transmitted back to the U.S. via polar orbiting satellites for use by researchers and for archiving at the National Climate Center in Asheville, N.C.

Logistics support is required in austral summer 78/79 and 79/80 for two men to deploy the AWS. In AS 80/81 and 81/82, logistics support is required for two men to repair and service the AWS units in the field.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Polar Programs

5.0006, RADIOWAVE DIAGNOSTIC STUDIES OF THE EARTH'S PLASMA ENVIRONMENT
V.H. Rumsey, University of California, San Diego Campus, Graduate School, Dept. of Applied Physics & Information Science, *P.O. Box 109, La Jolla, California* 92037 (ATM78-06770)

This grant will use the technique of interplanetary scintillation (IPS) to probe the solar wind in regions normally inaccessible to spacecraft. This technique allows an estimate of the solar wind velocity (and its random component) and the spatial spectrum of electron density. An observatory consisting of three widely spaced antennas operating at 74 mHz has been set up under previous NSF grants. It is well suited to measuring IPS at solar distances of 60 to 250 solar radii (Ro). In this range it is possible to concentrate on high latitudes observations.

The observations outside of 60 Ro will be regular and continuous. Thus they will be used to study the latitude structure of streams and by comparison the latitude structure of the corona. As the solar activity increases and transients become increasingly important, it will also be possible to map the spatial structure of these events. Observations inside 60 Ro are more complex because the solar wind is more variable. However, by using multiple antennas and/or multiple frequencies the velocity and spatial spectrum can be reliably estimated. The basic objective is to study the development and evolution of turbulence in the acceleration region of the solar corona as it expands to become the solar wind.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0007, SEASONAL CLIMATE FORECASTING
E.B. Weiss, Georgetown University, Law Center, *660 New Jersey Ave. N.W., Washington, District of Columbia* 20001 (OCE78-21646)

The North Pacific Experiment (NORPAX), which measures variation in the surface temperature of the northern Pacific Ocean, may lead to an operational capability for seasonal prediction of weather patterns over the continental United States. This project will study the impact of such predictions for the management of energy resources.

A model will be developed to simulate for the northern United States the impact of climate on oil and gas consumption, using data from the 1976-77 and 1971-72 periods, which had severe and relatively mild winters, respectively. Simulated climate forecasts of the type that may reasonably be expected to come from the NORPAX research will be applied to the model to then forecast energy consumption. Energy decision-making as it is presently carried out in the public and private sectors and as it might be carried out in the presence of qualitative seasonal climate predictions of varying degrees of accuracy will be studied. Alternative strategies available to government and to the private sector to take advantage of such climate forecasts will be developed and institutional adaptions useful to government and to the private sector (when experience shows seasonal climate forecasting to be a reliable technology) will be identified. The project will also examine the impact of seasonal climate predictions on United States foreign policy, focussing on the energy sector, and study the implications of alternative policies for dissemination of these predictions.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Ocean Sciences

5.0008, EXPLORATION OF INTERSTELLAR MOLECULAR CLOUDS BY SUBMILLIMETER POLORIMETRY
R.H. Hildebrand, University of Chicago, Enrico Fermi Inst., *5801 S. Ellis Ave., Chicago, Illinois* 60637

In the last decade it has become possible to do infrared mapping of interstellar clouds which are undetectable or, at best, only partially observable in visible light but emit thousands or millions of times the total luminosity of the sun in the far infrared and submillimeter bands of the spectrum: i.e., in the wavelength bands approximately 10 to approximately 100 microns and approximately 100 to 1000 microns. These energetic clouds are complex objects, containing newly formed stars, protostars ionized plasmas and denser regions of cold gas and dust. It is the thermal radiation from the dust which produces the great flux of far infrared and submillimeter radiation.

From polarization studies of absorbed and scattered radiation at visual and mid-infrared wavelengths, one infers that the dust grains are non-spherical and are aligned by the magnetic field within the cloud. If this is so, the thermal emission from the grains (at far infrared and submillimeter wavelengths) should be polarized. The degree of polarization and its wavelength dependence can be used to infer the structure of the magnetic field in the cloud and characteristics of the grains.

We propose to investigate the polarization of the submillimeter emission from luminous molecular clouds (in particular, Sagittarius A, a large cloud near the center of the Galaxy, and the Kleinmann-Low Nebula, a component of the Great Nebula in Orion), using techniques already developed in our laboratory. Except for our own preliminary observational tests on Venus and Jupiter, these would be the first such observations for any celestial objects.

SUPPORTED BY National Geographic Society

5.0009, LAKE-EFFECT SNOW STORMS
R.R. Braham, University of Chicago, School of Physical Sciences, Dept. of Geophysical Sciences, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (ATM78-18459)

Intense snow storms are generated on the lee shore of Lake Michigan during the early winter months when cold air flows over the relatively warm lake waters. These snows are important meteorologically and because of their socio-economic impact on the region. Lake Michigan is near the upwind end of the Northeast Corridor, that belt of industrialization-urbanization stretching from Chicago-Gary to the east coast. Snow storms in the Northeast Corridor are important scavengers of air pollution and may in turn be modified by pollution.

This research is pursuing three principal objectives: 1. To develop a coherent model of the circulations, cloud microphysics and precipitation mechanisms of lake-effect snowstorms. 2. To observe and describe anthropogenic influences on winter clouds and cloud nuclei. 3. To complete a numerical modeling study of mesoscale boundary layer circulations with applications to the urban heat island and lake snowstorms.

Field measurements are conducted near Muskegan, Michigan during early winter. The field program centers around co-

ordinated use of an instrumented aircraft and a dual-wavelength Doppler radar. The field program cooperates with a study of air pollution scavenging from the same lake storms.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0010, STUDIES OF IONOSPHERIC SCINTILLATION PROBLEMS
C.H. Liu, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (ATM77-22485)

Recent coordinated observations have now provided a sufficiently meaningful data base defining the equatorial ionospheric irregularities that quantitative modeling is possible. One of the most striking results is the Jicamarca incoherent scatter observation of plume like structures which now have led many to view the instabilities as due to instabilities associated with upwelling of depleted plasma density regions (bubbles) from the lower F regions. Radar, in situ, and scintillation data provide a broad spectral picture of the phenomenon.

This grant will fund the processing and analysis of this data with emphasis on the possible link to the phenomenon of rising bubbles. Preliminary calculations for the satellite transmission data base have shown one a priori viable hypothesis, ducting in the field aligned bubbles, to be unlikely; while another hypothesis, multi-path type refractive scattering at the extreme sharp density gradients at the 'walls' of the bubbles, appears feasible. This will be examined in detail. It has been suggested that a hierarchy of instabilities may be operative during equatorial spread F to produce the full wave number spectrum of irregularities. The modeling will test scintillation dependence for a multi-frequency (amplitude and phase) data base.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0011, STUDIES IN PROBABILITY FORECASTING AND THE VALUE OF WEATHER FORECASTING
R.L. Winkler, Indiana University, Indiana University - Purdue University at Indianapolis, School of Business, Dept. of Quantitative Business Analysis, *1121 W. Michigan, Indianapolis, Indiana* 46202 (ATM77-24060)

The objectives of this research are to investigate probability forecasting in meteorology and to study the value of weather information in the context of weather-related decision making problems. The research will include the development of new methods through the use of experiments, surveys, specific meteorological applications, and other types of studies. The research program in the area of probability forecasting in meteorology consists of three types of studies: experimental studies, methodological studies, and surveys. The research program in the area of the value of weather information includes two types of studies: specific applications and methodological studies. These results are important for probability forecasting in meteorology, implications for probability forecasting and decision making in general, and specific implications for the particular meteorological situations.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0012, ANALYSIS OF SPACECRAFT CHARGING SATELLITE DATA
D. Delorey, Boston College, Chestnut Hill Campus, Graduate School, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF582320; F19628-79-C-0018)

AF function - communications, navigation and surveillance. Deficiency - lack of adequate methods of predicting geophysical conditions with the AF operating environment and their probable effects on the success of future AF operations. Objective - analysis and interpretation of environmental data collected from high altitude research satellite. How research contributes - leads to reliable methods for predicting geophysical conditions.

Develop and implement mathematical techniques and analytical routines to analyze geosyncronous space probe data to produce unified compacted geophysical data bases for integrated investigations of the spacecraft charging/discharging and plasma interaction phenomena.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0013, SPACECRAFT CHARGING AND GEOSYNCHRONOUS ORBIT
J. Feynman, Boston College, Chestnut Hill Campus, Graduate School, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF583410; F19628-79-C-0031)

AF function - communication, navigation and command. Deficiency -AF space systems are degraded through interaction with the space environment. There is inadequate knowledge of magnetospheric processes at geosynchronous orbit and in polar cap to meet AF requirements. Objective - to model the physical processes at geosynchronous orbit in order to understand how spacecraft build up large electrostatic potentials and how these potentials can be controlled. To investigate electrodynamic structures in polar and aurora region to determine how energy is communicated from solar wind to ionosphere. How research contributes - provides information necessary for building communication satellites that are capable of withstanding radiation damage in severe plasma regimes. Provides information as to how energy is put into the ionosphere and how the morphology of the ionosphere is modified by these inputs.

Analyze data from AF satellites to determine what physical processes are operative under varying external conditions at geosynchronous orbit and in the polar ionosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0014, ULTRAVIOLET AIRGLOW PHOTOMETER
H.A. Miranda, Epsilon Lab. Inc., *Bedford, Massachusetts* 01730 (DF582090; F19628-79-C-0019)

AF function - trans-ionospheric ranging and communications, remote ionospheric monitoring. Deficiency - present state-of-the-art in relating natural optical emission to the electron density profile is not understood well enough to permit remote satellite monitoring of the auroral oval. Objective - in situ measurements with rockets of UV fluxes. How research contributes - provides direct measurements of atmospheric parameters to correlate with other measurements and computer codes being generated in the auroral E program.

Contractor shall design, fabricate and test an airglow photometer to measure the altitude profile of ultraviolet airglow emissions during flight on sounding rockets.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0015, AURORAL OPTICAL STUDY
R.H. Eather, Keo Consultants, *Newton, Massachusetts* (DF248640; F19628-77-C-0097)

AF function - communications and detection. Deficiency - understanding effects both of precipitating particle and non-particle produced ionospheric disturbances which degrade communications at high and equatorial magnetic latitudes. Objective - investigate ionospheric disturbance phenomena by means of auroral spectral emission features measured with a sensitive T.V. system. How research contributes -provides a new and powerful technique for large-scale and high time resolution auroral measurements. Coordination with other simultaneous measurements from the AFGL airborne ionospheric observatory, NKC-135 aircraft, will allow comprehensive measurements of ionospheric response to substorms over sub-auroral, auroral and polar cap domains.

Perform comprehensive investigation of the latitude and local time behavior of large scale ionospheric disturbance phenomena resulting from auroral particle precipitation in the vicinity of the auroral oval. this investigation will be based primarily on ground and airborne all-sky imaging photometer, all-sky

camera and meridian scanning photometer auroral measurements. Investigate the dynamic properties of the equatorial F-region and the formation of ionospheric irregularities through associated airglow signatures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0016, LASER RANGE/VLBI DATA ANALYSIS
C.C. Counselman, Massachusetts Inst. of Technology, School of Science, Dept. of Earth & Planetary Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF583150; F19628-79-C-0064)

AF function - strategic aerospace systems. Deficiency - need for improved definition of launch site and target position uncertainties. Objective - development of precise geodetic measurements. How research contributes - it will allow improvements in costs, precision, versatility and timeliness of Air Force geodetic surveys.

Analyze data from lunar laser ranging and very long baseline interferometry to precisely determine variations in the earth's rotation rate and polar motion. LLR data will be used from McDonald observatory and other laser observatories as available. VLBI data will be collected approximately bimonthly from the Haystack, Owens Valley and Onsala (Sweden) radio observatories and data from other radio observatories will be used as available. Results from LLR and VLBI analyses will be compared.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0017, FLUORESCENCE FROM GASES
B.D. Green, Physical Sciences Inc., *30 Commerce Way, Woburn, Massachusetts* 01801 (DF581820; F19628-78-C-0115)

AF function - infrared targets and backgrounds. Deficiency - lack of knowledge of infrared properties of the atmosphere. Objective -analysis of data obtained from laboratory measurements. How research contributes - analysis of the properties of infrared atmospheric emission provide information about atmospheric composition and infrared backgrounds. The results of this research are necessary for understanding and predicting the infrared from natural and disturbed backgrounds.

Utilizing AFGL LABCEDE facility with its Michelson interferometer, a detailed analysis of the fluorescence phenomena in electron irradiated gases will be performed. These observations of radiative spectrum are invaluable in determining and quantifying the relevant electron, ionic and neutral chemical kinetics occuring in the irradiated system. The results will be applied to infrared models and will be directly applicable to understanding infrared backgrounds for Air Force surveillance systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0018, INVESTIGATIONS INTO TECHNIQUES FOR MEASURING STRATOSPHERIC TURBULENCE
G. Murphy, Tri Con Associates Inc., *Cambridge, Massachusetts* (DF580530; F19628-78-C-0194)

AF function - environmental impact statements of high altitude Air Force operations. Deficiency - current or anticipated Air Force operations in the stratosphere may deposit harmful material and it is important to be able to assess the dispersion and residence time of such material in the stratosphere. Objective - provide research into various techniques for measuring winds and turbulence at stratospheric altitude. This will lead to profiles of the dynamic stratospheric wind fields. How research contributes - this research is needed in order to design, develop and fabricate new instrumentation which will measure stratospheric winds and turbulence. This will provide information leading to an understanding of atmospheric transport which is important in assessing the impact of systems which may contribute to environmental pollution.

Investigate, design, develop new techniques and devices to measure stratospheric winds and turbulence with a frequency response of DC to 1KHz for altitudes up to 45 km. Devices may be but are not limited to corona and hot wire anemometers. Desired linear velocity range is 0-25 m/s with a resolution of 0.001 m/s. Instrumentation is to be balloon launched from remote sites in usa.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0019, RADIO INTERFEROMETRIC STUDY OF SOLAR FINE-SCALE STRUCTURES
K.R. Lang, Tufts University, Medford Campus, School of Arts & Sciences, Dept. of Physics, *Medford, Massachusetts* 02155 (DF582610; F19628-79-C-0010)

AF function - communication and surveillance. Deficiency -capability of medium-range (1-5 day) prediction of operationally disruptive solar activity does not presently exist. Objective - to investigate the time-varying fine-scale structure of the microwave radiation from solar active regions by very high resolution radio interferometry. How research contributes - will provide a knowledge of flare precursor mechanisms needed to establish prediction techniques to forecast electromagnetic and energetic-particle emissions that disrupt HF communications, OTH radars, and satellite sensors.

Microwave observations (in brightness temperature and polarization of the time-varying fine-scale structure of very small sources in solar active regions will be made using two-element interferometers at NRAO or JPL and the aperture-synthesis network of the very large array (VLA) at Socorro, N.M. The greater radio-radiation detail made possible through the use of these very high resolution instruments will hopefully lead to greater knowledge of the flare triggering mechanisms present in very small sources. Any possible flare precursors will be evaluated for their importance as operational predictors of disruptive solar activity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, IONOSPHERIC REFRACTION FOR DEEP SPACE SURVEILLANCE RADARS
R.S. Allen, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580880)

AF function - advanced radar and navigation systems. Deficiency -the sensitivity of ground based and satellite radars which detect and track deep space targets is severely limited by ionospheric effects. The normal variability of the ionosphere causes target signal phase to vary so rapidly that present and proposed radars can only integrate coherently for small samples of 10 to 100 seconds. Objective - develop a technology to support ADCOM requirements for deep space systems, tailored to the range extension modification of SPADATS radars and to the deep space surveillance radar system. How research contributes -increases the sensitivity of radar detection and tracking in deep space so that trade-offs can be made between system performance and costs. Provides a technique to use local measurements of changes in the ionosphere so that AWS predictions of median ionospheric conditions can be adapted to the real time conditions in the attack corridors. This will make the range extension feasible at existing ADCOM radars. Provides design and development technology for the follow on deep space surveillance systems for use in preliminary design and system development. Investigate time rate of change of ionospheric refractive effects for deep space surveillance systems, using existing AFGL models of electron density profiles and of ionospheric parameters. Develop and validate computer algorithms so that the Air Weather Service can provide a monthly median prediction of refractive effects for deep space radars. Develop adaptive techniques to use real time local radar and ionospheric measurements to correct for the hour to hour variability of the ionosphere. Determine the optimum grid of local observations and the optimum interval between updates to meet the performance requirements over the system field of view.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, LARGE SCALE CLOUD SYSTEMS
L.V. Delgado, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581340)

AF function - military operations involving Air Force vehicles and erosion effects on nosecones during reentry. Deficiency - there is a need for statistical information on hydrometeor size distribution and crystal habit for weather erosion programs and for their effects on systems operated on high-performance aircraft. Objective - to measure, describe and develop prediction techniques for the microphysical characteristics of clouds. How research contributes - this research will provide a broader data base for characterizing hydrometeors in large scale cloud systems and will advance our understanding of these cloud systems.

Data collected during past years on ABRES and Minuteman weather erosion programs will be reviewed and combined with new hydrometeor data obtained with improved instrumentation on the present program to provide suitable statistics for hydrometeor characterization. New sampling instruments will be developed and flown to enable more accurate measurements to be made of hydrometeor sizes and crystal habits.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, CORRELATIONS BETWEEN OPTICAL AND RADIO OBSERVATIONS OF CORONAL HOLES AND ENVIRONMENTAL DISTURBANCES
H.L. Demastus, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580800)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate knowledge of solar environment, disturbances, and physics limits ability to predict events which disrupt and degrade AF systems. Objective - to determine the correlation between solar 'coronal holes' (regions of unusually low density in the corona), as observed in both the optical and radio regions of the spectrum, and geomagnetic disturbances. How research contributes - a definite relationship has been discovered between coronal holes as observed in soft x-rays from satellites and rockets, and the source of high-speed solar wind streams. At times of low solar activity these patterns become long-lived and result in recurrent geomagnetic storms. These in turn affect Air Force systems and communications, and are the subject of prediction efforts by the Air Weather Service. Because observations of coronal holes by satellites and rockets are not available continuously, they are not well suited to ongoing prediction schemes, so AWS requires more regular observations of these phenomena. This work unit will investigate a number of possible ground-based observation schemes, as well as the specific relationship between the time and space location of coronal holes observed by these methods and geomagnetic disturbances. the success of this work unit will result in more reliable predictions of geomagnetic disturbances for AWS. This effort directly supports the task objectives of isolating causes and propagation mechanisms of solar-induced environmental disturbances.

Observations of coronal holes will be attempted in the atomic lines of Fexiv 5303a and HeI 10830A, and in the radio spectrum. The present instrument for observing Fe53O3 at Sacramento Peak Observatory (SPO) will be upgraded by the addition of a system designed to suppress scattered light from the objective lens and the atmosphere. The suppression instrument will be developed under contract utilizing frontier technology that is untested in this particular application. techniques for observing He10830 both photographically and photoelectrically will be developed in collaboration with Aura (NSF contractor) personnel at SPO. A feasibility study will be conducted to develop and test a diode-array observing system to produce spectroheliograms in He10830 utilizing an existing instrument at SPO. Radio observations have been obtained. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, EMULSION PACKAGE FOR SPACE SHUTTLE
R.C. Filz, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580730)

AF function - communications and survivability. Deficiency or opportunity - improved prediction of space radiation resulting in improved prediction of spacecraft systems life cycle cost. Objective -to design, construct, and space-qualify the long duration exposure emulsion package (LDEEP) for the LDEF space shuttle flight. How research contributes - provides definitive data on low energy trapped particle fluxes required to improve models of the radiation environment in space.

A special nuclear emulsion sliding plate mechanism will be designed to obtain daily observations of 1 to 100 mev trapped proton fluxes over the six-month life time of the LDEF flight. Special techniques will be developed to shield the emulsion from background. Emulsions will be selected and calibrated for use with six-month space exposure. Mechanical and electronic devices will be designed, constructed and space qualified.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, SCATHA ENVIRONMENTAL ATLAS
H.B. Garrett, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583240)

AF function - AF communications satellites at synchronous orbit are degraded by satellite charging induced by the plasma environment. Deficiency - the space environment during periods of satellite charging is not sufficiently defined. Objective - comprehensive specification of the geosynchronous electron and ion population. How research contributes - plasma data from the SCATHA satellite will be used to supplement the AFGL geosynchronous plasma atlas allowing a complete specification of the geosynchronous orbit environment. The specification will aid in the understanding of the spacecraft charging phenomenon which is necessary so that steps may be taken to prevent damage to satellites from electrostatic discharges (ESD). This work supports a MIL Standard which contributes to operational capabilities of AF satellites.

Data from the SCATHA (satellite charging at high altitudes) satellite will be incorporated into the AFGL geosynchronous plasma atlas to provide a final comprehensive specification of the geosynchronous and near-geosynchronous plasma environment. The specification will be the basis of a MIL Standard.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, AURORAL E-LAYER
A.P. Krukonis, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580970)

AF function - HF radio wave communication, OTH radar system. Deficiency - variability of auroral E-layer leads to impairment of propagation characteristics of this E-layer mode. Objective - mapping of circumpolar auroral E-layer as function of magnetic activity. How research contributes - understanding of auroral E-layer characteristics will assist providing improvement of operation of HF communication and radar systems through polar regions.

Airborne noon sector ionospheric auroral E-layer data and simultaneously acquired satellite particle and ground based ionospheric data will be analyzed to determine the temporal and spatial characteristics of the circum-oval auroral E-layer. The results of a recently completed case study will provide the background for selection and study of data taken during IGY (1957-1958), a high sunspot period, during which a greater number of ionospheric stations were operating. Ionograms, representative of auroral zone and polar cap stations will be scaled to provide FOEA, H'EA, FBES, H'ES and FMIN. Initially, periods of moderately high magnetic activity will be analyzed to determine if an auroral E-layer existed in much or all of the polar cap during such time. If 'mantle' E-layer did exist, the analysis will be expanded to include a complete data base. Concurrently, a completed study of the statistical relations between precipitating particle flux and the location of the diffuse aurora derived from analysis of J-data and DSMP photos will serve as a basis for determining: 1) the spatial differences between the particle and optical boundaries of the E-layer of the oval, 2) vs magnetic activ-

ity indicators (i.e KP, AE, Q, DST). The end result of the total effort will be to produce maps of E-layer parameters for the Northern Hemisphere as a function of magnetic activity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, AIRCRAFT ICING PROBABILITIES
I.A. Lund, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583010)

AF function - design and operation of aircraft. Deficiency - more accurate icing information is required because new airframes such as the A10, HH-53, cruise missiles, RPV's and PGM's operate without anti-icing/deicing capabilities. Objective - to collect objectively measured ice accretion observations and to relate them to observations taken by standard radiosondes, and also to relate them to concurrent observations of liquid water content, drop size distributions and associated temperatures. How development contributes - icing probabilities will be used for determining the need of anti-icing/ deicing capabilities, in mission planning, in the setting of design criteria, and the development of operational procedures for flight safety. Observations of icing conditions are needed to obtain verification statistics on current forecasting methods, and to develop and test new methods.

The AFGL/LY MC-130E research aircraft will be instrumented with a Rosemont Model 871 FA ice detector. When the aircraft is available at Wright-Patterson AFB and icing conditions are forecast above a radiosonde station, within about 300 miles of Wright Patterson AFB, the aircraft will be dispatched to take observations approximately concurrent with and along the flight of the radiosonde. A number of such flights will be made. The MC-130E will also take icing observations on its flights which are not directly related to this effort, the C-5A, F-15, F-14, F-111, etc. of the Air Force and the L-1011 of Eastern, Delta and TWA also have Rosemont ice detectors. Efforts will be made to obtain observations from flights with some of these aircraft also.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, DEVELOPMENT OF NEW TECHNIQUES FOR FLARE PREDICTION
D.F. Neidig, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583170)

AF function - communications, surveillance detection, tracking. Deficiency - inadequate knowledge of solar environment, disturbances, and physics limits ability to predict events which disrupt and degrade AF systems. Objective - to develop techniques for improving predictions of solar flares. How research contributes - reliable prediction of flare - induced geophysical disturbances is needed to assure optimum performance and design criteria for AF communication, detection and navigation systems. These predictions require continuous magnetic field data such as the solar observing optical network (SOON) can supply. New techniques for the measurement and interpretation (within a flare-forecasting framework) of magnetic fields and other physical parameters need to be developed in order to achieve the required prediction capability. The effort in this IHWU is directed toward the identification and early detection of the solar conditions leading to flares.

To predict solar flares and their associated geophysical disturbances requires: (1) identification of solar active regions which will be flare productive, (2) detection and early recognition of flare phenomena (before geophysically significant emissions occur), (3) real-time evaluation of flare characteristics which lead to geophysical effects. Observable parameters relating to these areas, collected from optical, radio, and magnetic data, will be systematically evaluated in order to determine the parameters which are most significant in predicting both the occurrence of flares and their geophysical importance. New techniques for the measurement and interpretation of solar magnetic fields and other physical parameters will be tested for application to the SOON telescopes, these, in turn, will add to the data base of possibly significant flare parameters. The procedure will use a multivariant discriminant analysis (MVDA) which, in addition to identifying significant parameters, is also capable of making flare predictions from active region data. Optical data from the AWS-SOON network, as well as microwave data from supporting contracts, will be incorporated with observations made at Sacramento Peak Observatory in order to determine the significance of suggested prediction parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, PHOTODISSOCIATION OF CLUSTER IONS
J.F. Paulson, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582790)

AF function - nuclear weapons effects, environmental effects of AF operations. Deficiency - inadequate knowledge of reaction rates for prediction of composition, density and ionization of perturbed atmosphere. Objective - to measure cross sections for photodissociation of atmospheric cluster ions. How research contributes - provides information used in computer models to predict the effects of pollutants and of natural and nuclear atmospheric perturbations upon ion composition of the stratosphere and mesosphere.

Cross sections for photon induced dissociation reactions of cluster ions are measured in a double mass spectrometer system. A tunable dye laser, with frequency doubling, is used as a photon source. Ionic products of the dissociation reactions are mass and velocity analyzed. Energy disposition in the reaction is determined from the velocity distribution of the products.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, SHUTTLE EJECTION STUDY
L. Katz, Visidyne Inc., *Burlington, Massachusetts* 01803 (DF583650; F19628-79-C-0109)

AF function - communications, satellite survivability and surveillance. Deficiency - inadequate knowledge of the effects of charged particle ejection systems on space transportation system vehicles. Objective - to study and determine Air Force applications of space transportation system charged particle ejection systems. How research contributes - the research will determine both the advantages and disadvantages of Air Force applications of charged particle ejection systems on vehicles of the space transportation system.

A plan will be developed for a series of charge ejection payloads for the space transportation system. The purpose of these payloads will be the systematic study of the advantages and problems of using charged particle ejection systems on space vehicles for direct military applications and for studying geophysical problems relevant to Air Force application. The problems of environmental modifications, and direct dangers to personnel, vehicles and equipment will also be investigated. a complete charge ejection payload for space shuttle use will be designed based on the overall plan and studies of relevant problems and opportunities.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, DESIGN OF AEROSPACE EXPERIMENTAL INSTRUMENTS
J. Otis, Wentworth Inst. of Technology, Undergraduate School, *550 Huntington Ave., Boston, Massachusetts* 02115 (DF580010; F19628-78-C-0017)

AF function - military operations of the B-1, F-15 and other AF vehicles in the stratosphere, nuclear weapons delivery, communications, detection, track, and intercept. Deficiency - environmental effects of AF stratospheric operations cannot be predicted because of a lack of stratospheric data. Further, mixing and chemical effects of jet engine or missile effluents are only poorly defined. Also, inability to forecast upper atmosphere interactions affecting the design and operation of military systems such as reentry vehicles, over-the-horizon radar, polar communications and satellite ephemerides. Research -design, test and provide quadrupole mass spectrometers and gas sampling hardware with associated support equipment to be used in rocket and balloon-borne experiments. Cryogenic, vacuum, and

contaminant-free technologies are used. How research contributes - establish stratospheric standards and criteria by period in-situ and laboratory gas analysis and provide data for upper atmospheric assessment models by measurement of neutral and ionized species.

Consultation between experimenters and mechanical designers to include review of mechanical designs and monitoring the fabrication, delivery of prototype instruments, testing in flight configurations, design, updates, if necessary. Designers may be required to operate instruments during field experiments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0031, RELATING SOIL AND LANDSCAPE CHARACTERISTICS TO LAND USE

F.C. Westin, South Dakota State University, Agricultural Experiment Station, Dept. of Plant Sciences, *Brookings, South Dakota* 57006 (0071295; SD00769)

OBJECTIVE: Using adapted crops, develop models or quantitative equations to predict yields or suitability based on soil and landscape properties. Test and apply the ratings developed above.

APPROACH: Committee members will serve as subcommittee organized by crops or interpretation to evaluate soil climate and landscape parameters for yields and suitability ratings. Compare crop ratings developed with actual yields; compare land value ratings with actual land values by cooperation with economists; work with planners, managers, builders to test engineering interpretations; experiment with techniques to communicate information to user groups (computer maps, computer graphics).

PROGRESS: Research efforts to support this project are grouped under several headings: (1) soil genesis, (2) cartography, (3) relationships between soil map units and intepretations for agronomic, engineering and recreation uses of soils. To support these aspects several publications were prepared. A journal article was published on Organic Phosphorus Changes Over a Growing Season. About half of the phosphorus in S.D. soils is in the organic form so the behavior of this fraction is important for crops. The study was designed to see if soils on different landscape positions had different levels of organic phosphorus and if these levels were affected by moisture and temperature changes over a growing season. A second journal article was published dealing with the identification of soil associations and vegetation using satellite data. With the growing interest in crop inventory by satellite imagery, it is important to know the limits of these techniques under S.D. conditions. A second objective was to investigate the feasibility of using satellite imagery to identify soils. Two experiment station bulletins were co-authored with D.D. Malo. The first was an overhaul of a bulletin describing the occurrence, use and management of South Dakota soil. Included are a soil map in color, descriptions of the soil, yield potentials of the soils, and maps describing the use of soils. The second bulletin describes an agronomic rating system for all soil series and phases presently in use in South Dakota.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, South Dakota

5.0032, DIGITAL IONOSONDE STUDIES OF THE IONOSPHERE AT SIPLE STATION, ANTARCTICA, AND ROBERVAL, QUEBEC, CANADA

G.S. Stiles, Utah Higher Education System, Utah State University, Center for Research in Aeronomy, *Main Bldg., Office 104, Logan, Utah* 84321 (DPP77-22170)

One of the newly developed digital ionosondes will be acquired. After successful laboratory tests, and suitable software development, this unit will be installed at Roberval, Quebec, Canada, for research on the ionosphere there in conjunction with other experimental programs on the ionosphere and magnetosphere now being conducted at Roberval.

After a year's operation at Roberval, the ionosonde will be shipped (in the summer of 1980) to Siple Station, Antarctica, its ultimate destination, for correlative studies of VLF wave-particle interactions, the F-layer trough and its relationship to the plasmapause, and the effect of the ionosphere upon magnetic variations. Another digital ionosonde, on loan from the Chatanika facility in Alaska, will be installed at Roberval in 1980 to permit studies of the conjugacy of convection, electric fields, thermospheric winds, and particle precipitation.

Antarctic logistics support is required for three people at Siple Station during the austral summer of 1980/81 and for one winter-over person during the austral winter of 1981.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0033, INVESTIGATION OF THE CIRCULATION AND PRECIPITATION STRUCTURES OF SOUTH CHINA SEA DISTURBANCES DURING THE WINTER MONEX

J. Simpson, University of Virginia, School of Arts & Sciences, Dept. of Environmental Science, *Garrett Hall, Charlottesville, Virginia* 22903 (ATM78-00233)

The objective of this proposal is to study weather disturbances in the South China Sea as a part of the U.S. program under the Monsoon Experiment (MONEX), a regional subprogram of the Global Atmospheric Research Program (GARP). The principal platform for these studies will be the National Center for Atmospheric Research (NCAR) Electra Aircraft. MONEX is a study to increase our knowledge and understanding of the dynamics and thermodynamics of the atmosphere and ocean in monsoon regions of the world. The monsoon is an intense regional weather phenomenon, but is second only to the global general circulation of the atmosphere (the Hadley Circulation) in energy content and, therefore, affects weather and climate on a global scale.

Specific research goals are to investigate: 1) The relationship between growth, development and decay of South China Sea disturbances to the cold surges of the winter monsoon; 2) The small-scale structure of these disturbances, the organization of their clouds and precipitation; and 3) How the monsoon and the disturbances, down to the small-scale cloud structures, interact to control or modulate precipitation over the maritime continent of Malaysia.

These investigations contribute to two main MONEX objectives: 1) Improved precipitation forecasting for the Malay Peninsula, a vital problem owing to the heavy flooding often occurring in early winter; and 2) Documentation of the latent heat supply for the winter planetary (Hadley cell) circulations in the Asian Monsoon area.

A secondary objective of this research is to compare the dynamics, thermodynamics and structure of cloud and disturbance scale weather phenomena over the monsoon region with those over the GARP Atlantic Tropical Experiment (GATE) area. The PI and her group were active participants in GATE which was carried out in 1974.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0034, GENERAL CIRCULATION STUDIES

J.M. Wallace, University of Washington, School of Arts & Sciences, Dept. of Atmospheric Science, *Seattle, Washington* 98105 (ATM78-07369)

This research is directed toward a deeper understanding of the atmospheric general circulation, which exerts a strong influence on the geographical and temporal variability of climate.

One major area of effort involves the geographical variability of the time averaged general circulation; as manifested in the so-called 'standing waves' which occur in response to longitudinal heating contracts and the uneven topography of the earth's surface. The time averaged jet streams and storm tracks occur in certain preferred positions relative to these standing wave patterns. These features will be investigated by means of observational studies based on long time series of synoptic maps, sea-surface temperature analyses and satellite imagery, together with theoretical studies based on a primitive equation spectral model.

The temporal variability of the general circulation will be the subject of a number of closely related observational studies

which will focus on the frequency dependence and three-dimensional structure of natural climate fluctuations on time scales ranging from seasons out to about a decade. From such studies it is hoped a clearer understanding will be gained of the physical processes which control such variability. A number of feedback mechanisms will be considered which may contribute to short-term climatic variability. Major emphasis will be placed on interactions involving the temporal variability of sea surface temperature, cloudiness, and certain characteristics of the stratospheric circulation.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, DEVELOPMENT OF A METHODOLOGY FOR AIRCREW WORKLOAD ASSESSMENT
J. Buck, Auburn University, Graduate School, *Auburn, Alabama* 36830 (DF325210; F33615-78-D-0617)

The objective of this effort is to establish techniques and criteria for aircrew performance/workload assessment based on job and time standards methods. The method must take into account cognitive as well as motor, or psychomotor, demands of critical aircrew tasks.

Conventional industrial engineering techniques and metrics will be evaluated in the light of aircrew functions and associated tasks to identify necessary adaptations or additions to assure compatibility of industrial practices with Air Force operations. Criteria for assuring the effectiveness of any required modifications or additions to conventional techniques will be established. The criteria will be applied to preliminary tests of the effectiveness of the adapted methodology for a selected aircraft. The resultant method will be appropriate for generating data inputs to a computer-based data bank compatible with man-machine system modeling requirements. Initial emphasis will be on single-place aircraft. Task analytic data, time-line analyses, and an aircraft simulator will be used to support the methodology development and verification process.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Aerospace Medical Research Lab.

6.0002, AFHRL/NTEC ASPT/AWAVS COOPERATIVE RESEARCH-CARRIER LANDING
R.R. Woodruff, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF224190)

To determine pilots' ability to perform carrier landings using a wide field of view following training under either wide field of view or narrow field of view conditions.

A carrier modeled for use with the ANAVS will be displayed in the ASPT. Three groups of T-38 IPs will be trained in carrier landings. Group A will fly a circling approach and landing under wide FOV conditions, Group B will fly a circling approach and landing under narrow FOV conditions. Group C will fly a straight-in approach under narrow FOV conditions. After completing these training trials, the IPs in Groups B and C will fly circling approaches and landings under wide FOV conditions. The IPs in Group B will be provided audio or visual stimuli designed to cue them as to when they should begin their turn to final approach. The number of trials required to reach a criterion level of performance will be recorded and analyzed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human
Resources Lab.

6.0003, PERSONNEL TECHNOLOGY - PARAMETERS OF VISUAL SEARCH CAPABILITY
J.E. Hoffman, University of Delaware, School of Arts & Sciences, Dept. of Psychology, *Newark, Delaware* 19711 (DN875565; N00014-78-C-0762)

Many Navy and Marine Corps jobs (e.g., flying) require rapid and efficient visual search at the same time as other information-processing tasks. This work is concerned with the extent to which such search tasks interfere with other tasks, or vice-versa. Specific objectives are to formulate a stage model of search, deermine how speed and automaticity of search develop in search tasks, and identify the best predictors of an individual's capacity to develop such automaticity.

The model will formalize the notion of a fast parallel search of the display, followed, if necessary, by a slower, serial search. Development of automaticity will be characterized as increasing efficiency of the faster, parallel process. To test the model, data will be collected, experimentally, in a variety of search conditions, including those which do or do not allow the development of automaticity. Parameter estimates, on an individual basis, will be related both to overall performance and to selected psychometric measures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of
Naval Research

6.0004, HUMAN OPERATOR CONTROL STRATEGY MODEL
J.L. Birchfield, Georgia Inst. of Technology, Engineering Experiment Station, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DF228160; F33615-77-C-0042)

Develop and validate a model of human operator control strategy on perceptual/motor tasks such as flying and investigate relationships between control strategy and cue utilization, learning, and changes in task variables.

Identify human operator characteristics that ought to be considered, develop an operational definition of control strategy, conceptualize and implement a model based on a defendable theory-of-control strategy development and learning, and conduct extensive validation tests. Milestones - contract award, 1 Apr 1977, theory development, 1 Oct 1977, model design, 1 Dec 1977, model testing, 1 Oct 1978, first TR, 30 Apr 1979, validation, Dec 1979, second TR, May 1980, optional demonstration, Oct 1980, final TR, Mar 1981.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human
Resources Lab.

6.0005, ANALYSIS OF REFRESHER PHYSIOLOGICAL TRAINING
F.D. Leimkuhler, Purdue University, School of Industrial Engineering, *Executive Bldg., West Lafayette, Indiana* 47907 (DF325610; F33615-78-D-0617)

Air Force regulation 50-27 requires that air crew member receive appropriate physiological training every three years. The course presently taught is a broad spectrum educational effort covering many environmental stresses. This training currently employs low pressure flight chambers and is designed to prevent aircraft and personnel loss following biomedical effects that can be induced by the flight environment, e.g., decompression and hypoxia. An apparent new method of training which employs mask-applied gas mixtures, rather than flight chambers, has been proposed. This contract effort will evaluate the new training proposal from the cost/benefit point of view and in so doing will provide improved methodology for subsequent training evaluations.

An operations analysis approach will be applied. Aircraft and personnel loss caused by physiological incidents will be examined and correlated with training course content to estimate prevention rates achieved. Alternative methods are evident and need comparison on a cost-benefit basis with analysis to include hardware and personnel costs and preventive capabilities. Alternative training methods will be studied to estimate their prevention capability with a final trade-off being accomplished via comparison of prevention vs. cost.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of
Aerospace Medicine

6.0006, SPACEGRAPH IOS DISPLAY STUDY
L.D. Sher, Bolt Beranek & Newman Inc., *50 Moulton St., Cambridge, Massachusetts* 02138 (DF228820; F33615-79-C-0013)

The objective of this effort is to study the various ways in which the unique 3-D capabilities of the space graph display can

be matched to the specialized display problems of the IOS of a modern flight simulator.

The study will examine the overlap between the information-display attributes of an IOS and the corresponding attributes of spacegraph which promise utility in IOS applications. The work will include identifying and categorizing the types of information to be displayed and current characteristics of spacegraph which are applicable, developing new ways of using space graph and examining those characteristics which promise utility, developing additional parts of the space graph system, generating priorities for future developments and demonstrating the system. Project initiation - 11 Oct 78; contract award - 1 Dec 78; display requirements - 1 May 79; new uses - 1 Oct 79; contract comp - 1 Jun 80.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0007, BIODYNAMIC RESPONSE

A.I. King, Wayne State University, School of Engineering, Dept. of Mechanical Engineering, *5950 Cass Ave., Detroit, Michigan* 48202 (DN123393; N00014-75-C-1015)

For the purpose of minimizing pilot injury, experimental and analytical techniques are being used to study the biodynamic response of naval pilots when subjected to parachute opening or ejection shock.

Because of the relevance of cervical vertebral motion to neck injury, improved instrumentation techniques are being planned to better determine vertebrae kinematics during test runs on cadavers or anthropomorphic dummies. In addition, some experiments are being contemplated wherein body motion will be examined subsequent to target impact and correlations attempted with mathematical models of the same.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

6.0008, VISUALLY ACQUIRED REFLECTIVE GLIDE SLOPE INDICATOR, LDF 79-10

H.L. Task, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325540)

The purpose of this effort is to design, build and test a reflective glide slope indicator that will use the aircraft landing lights as the light source. The VARGSI will provide a color coded reflection of the aircraft landing lights to visually cue the pilot to the correct glide slope angle.

There are several ways in which an optical system can be devised that would be capable of producing the desired effect. Each method has certain advantages and disadvantages in terms of intensity of the reflected light, ease of color coding, complexity and expense. Each design will be evaluated on paper. Working models of one or more designs will be produced and tested under lab conditions. The most promising design(s) will then be field tested to determine visibility and angle sensitivity characteristics under actual outdoor conditions. If the field tests are favorable, it is possible that the device would undergo flight testing. Tentative arrangements have been made with the Army Aeromedical Research Labs at Fort Rucker, AL to test the final device for helicopter landings. This effort is supported by O and M contract documented under work unit 71840006.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0009, VISUAL PERFORMANCE OF AIRCREW PERSONNEL UNDER SPECTRALLY SELECTIVE FILTER CONDITIONS

G.T. Chisum, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN081091)

To determine the effect of transparencies of various spectrally selective absorbencies on visual performance. Visors designed for both eye protection in special environments, such as laser exposure environments and high light environments, and for display purposes often selectively absorb and or reflect across the visible spectrum. The result is both distortion of environmental stimuli and selective adaptation of the visual processes. The extent to which these effects degrade or enhance visual performance will be assessed.

Visual task will be performed by human observers wearing spectrally selective filters. That performance will be compared with performance under unfiltered conditions, and the extent to which performance is degraded or enhanced will be determined. The results will be used to provide guidelines for the development and utilization of visual transparencies by flight personnel.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

6.0010, CAREER PROGRESSION AND PERFORMANCE OF ENLISTED AIR FORCE PERSONNEL

S.A. Brown, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF233030)

To investigate career progression and performance of enlisted personnel during the time period of 1 Jan 70 through 31 Dec 75 at yearly time intervals. Comparisons will be made during the time period to assess similarities between male and female enlistees in an attempt to achieve maximum utilization of female talent and potential and to determine pre-enlistment identifiers of desirable career personnel.

Biographic, attitudinal, and performance data will be compiled from airman record files on yearly input of male and female enlistees (1970-1975). Criterion data of special interest will include disciplinary actions, APRs, unsuitability discharges medical data (if available) and reenlistment. Particular attention will be directed to areas where male and female performance is disparate and to factors which may be related to early separation prior to completion of initial tour of duty. Where sample size is sufficient for meaningful interpretation, analyses will be accomplished by AFSC. Distributional, correlational and regression analyses will be accomplished. Milestones - generation of data base, Nov 76-Sep 77, 11 mos, computer analyses, Oct 77-Apr 78, 7 mos, interpretation of data, May 78-Sep 78, 5 mos, preparation of final report, Oct 78-Jan 79, 4 mos, TR clearance and reproduction, Feb 79-May 79, 4 mos.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0011, DEVELOPMENT OF THE PMS ENLISTED PJM

J.C. Fast, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF234240)

To develop a classification model that provides the same set of logical processes to be used in the pre-enlistment and post-enlistment phases of an airman's career. As a part of this, a policy system will be developed which calculates the appropriateness of assigning specific people to specific jobs vis-a-vis their contemporaries. Research started under work unit 20770401 and continued under 20770407 will be used as a basis for the work done under this work unit.

The methodology developed under 20770407 will be used to completely define a pipeline management system (PMS) enlisted PJM policy. An initial policy will be implemented using all the new variables identified previously. AFHRL will assist AFMPC in the implementation of this model and will continue to consult throughout the life of the work unit on operational problems. An algorithm for selection of candidates for HRP screening will be developed using data previously gathered by AFMPC. This algorithm will become part of the post enlistment classification system and will be used to enhance PJM. A simulation technique will be developed to allow managers to look at proposed policy changes and assess the impact on the operational system. AFHRL will continue to analyze the PJM history file to determine the effectiveness of PJM. Milestones - development of initial PMS policy (1 May 79), incorporation of new variables into PMS (1 Jul 79), assist in implementation process (as required), development of policy simulation (30 Jun 80), development of algorithm for assessment (1 Jul 79), final product (31 Oct 81).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0012, SCREENING OF PROSPECTIVE AIR TRAFFIC CONTROLLER OPERATORS

J.C. Quebe, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF233970)

To develop a controller oriented screening device for air traffic control (ATC) applicants. Present requirements are AQE score of 60 or better in administrative or general and a Class II physical exam (including ARMA), neither of which appear to be positive indicators of eventual success in the air traffic control field.

Analyzing the results from a 1975 FAA exam administered to ATC (27230) students at Keesler and of AQE scores, against performance in the ATC field, determine what factors in test batteries are predictive of success in the career field. Develop new screening device based upon the prediction parameters and employing current and advanced testing technology.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0013, TEST AND EVALUATION OF CHEMICAL DEFENSE EQUIPMENT & EXTREME CHANGES IN COCKPIT ENVIRONMENT

R.W. Krutz, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322610)

Previous efforts in this area were documented under work unit 7930-09-15. The purpose of this effort is to conduct inhouse test and evaluation of chemical defense personal equipment in direct support to the 412A life support SPO, chemical defense division (AEL). The work unit is structured to address biomedical and environmental test requirements that are expected to arise during various stages of new equipment development and modification of existing equipment by the SPO. The capability to conduct quantitative leakage assessment of CD respiratory devices will be established and the chemical properties of CD filter materials will be studied for their compatibility with the flight environment. The justification for establishing this supportive effort is based upon an approved memorandum of agreement between AMD and ASD/AEL (30 Jun 76), and TAF (ROC) 326-75, 7 Nov 75 (CW mask for tactical fighter aircrew). The MOA states that T&E support will be provided on a cost reimbursement basis, the latter defined as a specific cost schedule in AMD letter to ASD/AEL, 9 Feb 76.

The work unit monitor will serve as the OPR for the CD program to be accomplished within the USAFSAM. He will plan programs and coordinate all T&E activities to be accomplished by various organizations within the laboratory. However, laboratory elements at both the USAFSAM and AMRL will charge against this work unit to insure proper reimbursement. Specific areas of test and environmental simulation will consist of altitude exposure, including pressure breathing levels and rapid decompression, respiratory impedance measurements, thermal/cold effects, air combat manuevering (ACM) g exposures, mask leakage characteristics, equipment related performance decrement, and integration with other life support equipment and cockpit configurations. Realistic operational profiles for the environmental conditions will be simulated and the sodium chloride cloud technique will be utilized for lead testing purposes (actual CW agents, simulants or antidotes will not be used for any tests). The OPR and others will also provide biomedical consultation and review technical requirements for equipment design when requested.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0014, CREW UTILIZATION AND WORKLOAD ASSESSMENT FOR MAXIMUM OPERATIONS

W.F. Storm, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF325010)

Both strategic and tactical operations impose unique stresses and workloads on USAF air and ground crewmen. This work unit examines and evaluates crew fatigue, physiologic cost, and performance effectiveness during standard, contingency, and maximum effort operations such as long range/nonstop deployments, sortie surges, airborne and ground based C3 operations, low level/high speed ACM, and all-weather rescue operations. Guidelines for operational commanders on stress/fatigue loads and their effects on performance and safety are presented as crew utilization recommendations for use in planning and operational practice. Special emphasis is given to defining post-mission/post-duty rest and recovery requirements for single and repetitive missions/duty periods.

Currently established psychobiological and performance measurement methods are applied systematically to evaluate and scale crew effects of single and multiple operational stresses in order to identify optimized mission workloads and crew duty cycles. The current battery of field measurements includes subjective fatigue, mood, and activity questionnaires, biochemical analyses of urine samples for neuroendocrine and metabolic indices, and human factors engineering and workload evaluations. When appropriate and feasible, other psychobiological measures, such as temperature and heart rate, are also obtained. Other laboratories and scientific literature are constantly monitored for new and improved methods which may serve to better evaluate man/machine effectiveness in USAF operations. Laboratory studies complement field studies, providing for better controlled means of evaluating new performance and physiological tests for eventual field use and for validating data collected under the uncontrolled conditions of real world operations. Previous efforts now assigned to this work unit were ongoing under 79301002, 79301004, 79301005, and 79301020. Performance and physiological data collected in an inhouse laboratory study involving long duration missions in GAT-1 trainers is undergoing analysis and preliminary report preparation. A unique information processing task shows promise for adaptation to field studies. Crew fatigue data have been collected on 2 F-4 sortie surges, and a similar surge involving A-10s will be studied in mid-August. Evaluations of C3 operator fatigue will be conducted. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, FORMAL TRANSFORMS ARISING IN GEOMETRIC QUANTIZATION

R.J. Blattner, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Mathematics, *405 Hilgard Ave., Los Angeles, California* 90024 (MCS78-01332)

This continues research under MCS 7517621 A01.

Blattner will continue his work on geometric quantization by working on four problems. 1. Developing an indefinite Hodge theory adequate to describe the metaplectic representation of U(k,1). 2. Extending the half-form pairing to nonpositive polarizations using sheaf cohomology. 3. Understanding Rawnsley's nonunitary pairing arising in the 'Kepler problem.' 4. Extension of Kostant's pairing of symplectic spinors to the nontransverse case.

John H. Rawnsley will collaborate with Blattner on (1), (2) and (3) for three months.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

7.0002, DEVELOPMENT OF NEW CENTRIFUGE CONTROL ALGORITHMS

R.J. Crosbie, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN081187)

To investigate and establish criteria which will be used in the development of new algorithms for controlling the human centrifuge as a dynamic flight simulator. The current method of

controlling the centrifuge during dynamic flight simulations produces unrealistic and often undesirable angular artifacts to the simulator pilot. The proposed method will seek to minimize these angular artifacts and will provide a continuing benefit in optimizing the centrifuge control for all future centrifuge programs prior to their implementation.

An existing simulation, which includes mathematical models of the centrifuge, a generic aircraft, and an aircraft/centrifuge conversion network, will be used as it is excited by various simulated pilot inputs. By comparing human sensory response, both simulated and actual, to the dynamic environment of the simulated aircraft and the centrifuge, new centrifuge control algorithms will be developed which will minimize undesirable artifacts. When the simulated system is judged to be of optimum control, it will be incorporated into the actual aircraft/centrifuge conversion network and be validated through manned testing.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, MODERN SPECTROSCOPY AND COLLISION STUDIES OF FUNDAMENTAL ATOMIC AND MOLECULAR SYSTEMS

W.H. Wing, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (PHY77-15217 A02)

Research is proposed on three problems in modern spectroscopy of fundamental atomic and molecular systems. In the first project, a recently developed ion-beam infrared-laser resonance apparatus will be used to perform extremely high-resolution spectroscopy and collision measurements on the hydrogen molecular ion. In the second project, precise microwave-optical spectroscopic and collision studies will be made on highly excited helium atoms. Both these systems represent three-body problems fundamental to the understanding of atomic and molecular structure. In both cases the precision achievable is several orders of magnitude greater than is achievable by conventional optical spectroscopy.

The first project has the additional potential to improve knowledge of fundamental contrasts, especially mass ratios, and also will be extended to include other ions important in astrophyics, quantum chemistry, and high-temperature gaseous and plasma processes.

In the third problem theoretically predicted and recently observed velocity-dependent sharp features in the helium-neon excitation transfer process responsible for laser action, and the velocity dependence of metastable and Rydberg helium-normal helium collisions, will be studied by a computerized time-of-flight method.

This work is a continuation of that currently supported under NSF grant number PHY75-03549A02.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0002, EXPERIMENTAL STUDY OF ELECTRON-MOLECULE (ATOM) COLLISION PROCESSES

S. Trajmar, U.S. National Aeronautics & Space Admin., Jet Propulsion Lab., Physics Section, *4800 Oak Grove Dr., Pasadena, California* 91103 (INT76-22192)

This collaborative research project involves Dr. Sandor Trajmar of the Jet Propulsion Laboratory (Pasadena, California), with Drs. Sergio Porto, George Csanak, and Dimitrios Bozinis of the University of Campinas (Campinas, Brazil).

NSF is contributing to the linkage of these scientists for the purposes of expanding their research efforts in electron-molecule (atom) collision physics. The joint research efforts will be concentrated in areas which are of importance from the point of view of laser and plasma physics, isotope separation, and surface chemistry and physics. Three specific research areas have been chosen: a) Electron scattering from atomic and molecular beams. This will involve experimentation with lasers in metal vapors, and vibrational excitation of diatomic and polyatomic molecules. b) Isotope separation. Exploratory research on isotope separation through combinations of laser photoexcitation followed by selective photoionization or chemical reactions will be carried out. c) Electron scattering from surfaces. Here planning and feasibility studies will be done to utilize low- and intermediate-energy elastic and inelastic electron scattering for probing surfaces.

The laboratory measurements will be carried out at JPL by the two main investigators from each country. The evaluation and interpretation of the results will be shared and carried out at Campinas and JPL, and will be closely correlated with ongoing theoretical work at Campinas under Dr. Csanak.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0003, BASIC RESEARCH IN PLASMA PHYSICS

N. Rynn, University of California, Irvine Campus, School of Physical Sciences, Dept. of Physics, *Irvine, California* 92664 (PHY78-07816)

This research project will study certain basic properties of hot, full-ionized gasses (plasmas). An experimental and theoretical investigation of turbulent diffusion and transport across a magnetic field is proposed. The experimental program will use an extension of previously developed laser diagnostics to probe the density and the temperature of the plasma both in space and time. The development of the optical diagnostic techniques is discussed in detail. It is also proposed to investigate instabilities caused by anisotropic velocity distributions, parametric decay and excitation of ion cyclotron waves, plasma filamentation and the coherence of modes and 'clump' theory. All of these programs overlap at at least one point.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0004, MULTICRITICAL POINT BEHAVIOR

G.E. Everett, University of California, Riverside Campus, School of Natural & Agricultural Sciences, Dept. of Physics, *Riverside, California* 92502 (DMR77-11323 A01)

The research will employ detailed high resolution magnetization measurements for investigations of 'multi-critical' behavior in iron and europium selenide. It has been shown, using renormalization group techniques, that cubic ferromagnetic iron is equivalent to the theoretical Pott's model. Mean-field analysis has predicted several anomalous multicritical points for various directions of an applied magnetic field. Magnetization components parallel and perpendicular to the applied field will be measured versus field and temperature in single crystal samples in order to test these theoretical predictions.

Multicritical point-like behavior is also observed in EuSe for one field direction. A line of critical points which is required by symmetry considerations but which has not yet been observed will be investigated with high resolution experiments. The existence of multicritical behavior associated with other field directions and the dependence on uniaxial stress will also be investigated.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0005, FUNDAMENTAL PROCESSES IN PLASMAS

J.H. Malmberg, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (PHY77-20613 A01)

The research will include both theory and experiment and emphasize problems in plasma physics for which very precise experimental tests of theory can be obtained. Most of the experiments will be done with an important new type of plasma--an unneutralized, magnetically confined electron gas. Such plasma can be made by simple methods and contained for minutes, with the effects of both classical and anomalous transport clearly ob-

served. The first objective is to understand this transport in detail. A second objective is to increase the plasma confinement time until the electrons come to thermal equilibrium with each other. A third objective is to decrease the plasma temperature and increase the plasma density until electron-electron correlations become strong. One can speculate that if this development succeeds, the electron gas will liquify, and at very low temperature freeze into a crystal.

The research on the TWT experiment will also continue. The next objective for this work is to observe the 'explosive instability.' This class of instability has been predicted theoretically but has never been directly observed experimentally.

This work is a continuation of that currently supported under NSF grant number PHY73-05125A03.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0006, MEASUREMENTS OF THE ORDERED PHASES OF SOLID HELIUM-3

J.M. Goodkind, University of California, San Diego Campus, Revelle College, Dept. of Physics, *La Jolla, California* 92093 (DMR78-23974)

Research was previously supported by DMR7721014.

A Superconducting Quantum Interference Device (SQUID) will be used to study the spin-ordered state of solid helium-3. Nuclear cooling techniques will be used to extend specific heat and nuclear magnetic resonance measurements to ultra-low temperatures. Successful acquisition of these data will help in the identification of the nature of the spin-ordered states of solid helium-3.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0007, MICROSCOPIC STUDY OF LOW-LYING EXCITATIONS IN SUPERFLUID 3HE AND SUPERCONDUCTORS

K. Maki, University of Southern California, School of Letters Arts & Sciences, Dept. of Physics, *3551 University Ave., Los Angeles, California* 90007 (DMR76-21032 A01)

This is a continuation and extension of research started under NSF grant DMR74-23429. The basic thrust is to study the theory of dynamical properties of superfluid 3He and superconductors from a completely microscopic point of view. Specific problems under study are: 1.) Nonlinear Dynamics of Superfluid 3He - The basic equation governing the spin motion in superfluid 3He-A and B in the absence of dissipation has been derived. Explicit solutions of physical relevance remain to be found. 2.) Dissipation Phenomena in Superfluid 3He - A formulation of the transport coefficients in superfluid 3He-B has been developed. Of further interest is the effect of dissipative terms on the nonlinear spin-orbital dynamics of superfluid 3He. 3.) Surface Phenomena in Superfluid 3He - The magnetic coupling as well as the acoustic coupling between liquid 3He and magnetic or nonmagnetic substance will be studied. 4.) Low-Lying Excitations in Superconductors - Of particular interest are the fluctuation of the order parameter in the clean type II superconductor, and that in the type I superconductor far below the transition temperature. 5.) Dynamics of Superconductors with Periodic Substructures - The interaction between the periodic substructure and the vortex lattice will be examined and the effect of periodicity on the basic superconducting properties will be studied.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0008, THERMAL PROPERTIES OF SOLID HELIUM-3 AT VERY LOW TEMPERATURES

A.S. Greenberg, Colorado State University, School of Natural Sciences, Dept. of Physics, *Fort Collins, Colorado* 80523 (DMR78-09427)

A thermal conductivity apparatus will be modified so that constant volume and constant pressure samples of BCC 3He can be examined in a magnetic field. Systems comprised of solid helium isotopic mixtures in which spinodal decomposition has been observed will be investigated. Further studies of low-temperature amorphous systems will be made by means of CW ultrasonic spectroscopy. This is a continuation of work begun under DMR76-21341.

Solid helium-3 is of fundamental importance to understanding the quantum nature of condensed matter. This work will clarify the anomalous behavior of solid helium-3 at temperatures below 100 mK.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0009, NUCLEAR ACOUSTIC RESONANCE IN METALS

R.G. Leisure, Colorado State University, School of Natural Sciences, Dept. of Physics, *Fort Collins, Colorado* 80523 (DMR76-11117 A01)

The study of atomic motions in solids and how they influence the behavior of nuclear magnetic spins is an area of considerable interest in condensed matter science. The interaction between acoustic waves and nuclear spins will be investigated in several metals. Preliminary results on sodium will be extended in order to determine the mechanism responsible for coupling the acoustic energy to the nuclear spins in this material. The resonant attenuation of acoustic waves due to this mechanism (nuclear acoustic resonance) will then be studied near the temperature of the sodium martensitic phase transition. Previous nuclear acoustic resonance experiments on lead will be extended to a single-crystal lead-indium alloy. The absence of electric quadrupole effects on the lead resonance makes possible a particularly clean study of isotropic and anisotropic knight shifts. Careful nuclear acoustic resonance intensity measurements will be made in aluminum in the temperature-magnetic field range for which the Hall field vanishes. Preliminary results indicate a need for a revision of the dipolar coupling theory. A new class of nuclear acoustic resonance experiments will be explored. These experiments involve the concept of adiabatic demagnetization in a rotating reference frame.

This research was previously supported under NSF grant DMR-7611117.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0010, SUPERCONDUCTING AND NORMAL ELECTRICAL PROPERTIES OF ANISOTROPIC AND ION IMPLANTED MATERIALS

W.C. Moulton, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Physics, *205 Wildwood Dr., Tallahassee, Florida* 32306 (DMR78-21612)

Research initiated under grant DMR 7610845 will be continued and extended. Although the proposed program represents a single research effort involving a study of strong-coupled superconductors, detailed investigations will be performed in three somewhat diverse areas: 1) the hexagonal tungsten bronzes, 2) the layered dichalcogenides, and 3) ion-implanted samples of transition metal elements and compounds. Work with the bronzes will emphasize materials preparation and measurements of electrical resistance, Hall coefficient and Seebeck voltages. The objective of this work is a detailed study of compositional and ion-size effects upon a suspected high temperature phase transition and its relationship to the occurrence of high transition temperatures in these superconducting compounds. Studies concerned with the dichalcogenides and ion-implanted systems will concentrate on the effects which magnetic-ion additions have on the normal state and superconducting state properties of the host matrix. A newly commissioned vibrating magnetometer will provide additional data with regard to the magnetic state of these compounds. A superconducting solenoid will be used to extend studies of the field dependence of the Hall coefficient and magnetoresistance to magnetic field values as high as 5T. This work will yield essential data about the magnetic inter-

actions occuring in these compounds and their effects upon the technologically important parameters of the superconducting state.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0011, AN EPR-ENDOR STUDY OF EXOELECTRON EMISSION TRAPS IN CERAMIC AND SINGLE CRYSTALLINE BERYLLIUM OXIDE

A.K. Garrison, Emory University, Graduate School, Dept. of Physics, *1364 Clifton Rd. N.E., Atlanta, Georgia* 30322 (DMR77-00314 A01)

Continuation of research supported under DMR75-03281.

Electron nuclear double resonance (ENDOR) will be used to characterize the traps involved in exoelectron emission (EE) in the crystalline and ceramic forms of BeO which have been previously exposed to ionizing radiation. Since thermally stimulated EE (TSEE) is the basis for a sensitive radiation dosimeter made from ceramic BeO, the aim of the study is not only to increase the understanding of the basic EE processes but also to aid in the development of a more reliable TSEE detector.

Initial ENDOR studies done by the co-principal investigators have shown that lithium is present in the BeO ceramic dosimeter material at levels at least two orders of magnitude above that previously known. It serves as a charge trap and may be the primary trap in the exoelectron and luminescence processes. Once all the paramagnetic traps are characterized by ENDOR, it is proposed to use the ENDOR signals as unique microscopic probes into the role of these traps in the EE processes. This will be done by combining ENDOR measurements with TSEE and thermoluminescence (TL) readout, optical stimulation of the traps, various radiation and annealing treatments, electron paramagnetic resonance (EPR) kinetic studies and electric conductivity measurements.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0012, DEEP LEVEL DEFECTS IN SEMICONDUCTORS

S. Sundaram, University of Illinois, Chicago Circle Campus, School of Liberal Arts & Sciences, Dept. of Physics, *601 S. Morgan St., Chicago, Illinois* 60680 (DN875661; N00014-78-C-0732)

The operation of solid state electron devices used in Navy electronics systems is controlled by the electronic nature of impurity atoms incorporated in the semiconductor materials. Deep level impurities do not contribute directly to the material conductivity but affect carrier lifetime and recombination proceses. Such impurities and their effects are not understood and must be investigated for improving solid state devices.

Studies will be made of the electronic properties of deep level defects in gallium arsenide (GaAs) and indium phosphide (InP) produced by impurities such as chromium and iron. Photoluminescence measurements with and without uniaxially applied stress will be made to deduce the valence states and resultant energy levels of the impurity. Theoretical models based on crystal field theory will be developed to correlate predictions of luminescent intensities, and energy of deep levels with the experimental results. Various valence states will be considered, configuration mixed representations of the multi-electron systems will be used, and crystal symmetry models for various possible impurity configurations in the lattice will be included in the analysis.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0013, TIME RESOLVED SPECTROSCOPY OF THE ELECTRON-HOLE LIQUID IN SEMICONDUCTORS

J.P. Wolfe, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics, *207 Engineering Hall, Urbana, Illinois* 61801

At low temperatures, the photoexcited states of the semiconductors silicon and germanium may be simply described as classical particles. A gas of 'excitons,' bound electron-hole pairs analagous to hydrogen atoms, produces 'excitonic molecules,' analagous to molecular hydrogen (H_2), and may further condense to a (non-classical) metallic liquid phase. These particles disappear when the excitation light is removed. Recombination times (100 ns-1 ms) are determined by time-resolved spectroscopy, and basic properties of these photoexcited states will be determined by temperature-, stress-, and density-dependences of their lifetimes.

SUPPORTED BY Research Corp.

8.0014, QUANTUM LIQUIDS IN TWO AND THREE DIMENSIONS

J.M. Mochel, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DMR78-11538)

This is a continuation of work sponsored under DMR-7203291. An experimental study will be made of 4He between 10mK and 1K. An investigation of the properties of ultra thin films will be made by means of third sound resonance. The behavior of surface impurities of 3He as a two-dimensional Fermi gas, using the closed surface of 4He films as the substrate, will be studied. A new method of time-of-flight phonon spectroscopy in bulk 4He both with and without 3He impurities will be examined. This work is important to understanding the physics of quantum fluids.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0015, COMPARATIVE MULTICRITICAL POINT MEASUREMENTS ON ORDERED AND DISORDERED MATERIALS

M.B. Salamon, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DMR78-07763)

In Condensed Matter Science, there are many materials in which there are competing interactions. These materials generally are expected to have complex and interesting phase diagrams. In ordered materials such as metamagnets, the competition leads to a change in the nature of the phase transition from second to first order at a special point called the tricritical point. In randomly disordered systems, the nature of the magnetic state changes completely, giving rise to the spin-glass phase. Experimental detail on the nature of these phase transitions, is sparse. Experiments will be carried out on pure metamagnets, randomly diluted metamagnets, and magnetically random metallic glasses to fill the gap between experimental results and theoretical predictions. To do this it is necessary to measure thermodynamic properties and magnetic properties simultaneously because of the need to correct accurately for demagnetizing effects. Simultaneous critical point measurements will be made, using Faraday rotation to provide the needed magnetization data. These experiments will test existing theories of the multicritical point of metamagnets and explore the effect of randomness on the multicritical point. They will provide a new approach to the spin-glass problem by studying the evolution of the spin-glass phase from the magnetically ordered state as the degree of randomness is increased. This can provide new understanding of the magnetic behavior of non-crystalline materials.

This research was previously supported under DMR-7610379.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0016, RESEARCH ON QUASARS AT RADIO WAVELENGTHS

J.F. Wardle, Brandeis University, School of Arts & Sciences, Dept. of Physics, *415 South St., Waltham, Massachusetts* 02154 (AST78-01006)

Several areas of research on radio sources associated with quasi-stellar objects (quasars) will be carried out. The main topics will be concerned with the compact variable radio sources, the linear polarization and its wavelength dependence, the structure and evolution of quasars and the linear size distribution, and possible cosmological tests derived from observations. The observations and interpretations will include the angular structure and high frequency spectra of complete samples of quasars and the relationship of the angular size and red shifts of these quasars. The quasars are exotic objects which release hundreds of times more light than a single giant galaxy and give off enormous amounts of energy on timescales of days to months.

This is a continuation of research begun under grant AST 74-18631 A02.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

8.0017, DYNAMICAL THEORY OF CHARGED PARTICLE SYSTEMS

H.A. Gould, Clark University, School of Arts & Sciences, Dept. of Physics, *Worcester, Massachusetts* 01610 (DMR78-10306)

Theoretical research in condensed matter physics will be carried out. Past work on self-diffusion in a dense one-component classical plasma (electron gas) has shown that it is possible to perform realistic microscopic dynamical calculations of charged particle systems in the absence of a small perturbation parameter. The theory will be extended to treat the dynamical properties of superionic conductors and molten salts. The techniques and insights to be developed will also be applicable to a highly compressed plasma, quantum liquids, and classical dense gases. The theoretical calculations will be compared to results obtained from experiment and molecular dynamics.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0018, ATOMIC PHYSICS EXPERIMENTS USING FAST ATOMIC BEAMS

F.M. Pipkin, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (PHY78-09657)

Fast atomic beams will be used in conjunction with laser and radiofrequency spectroscopy techniques to make precision measurements of the fine and hyperfine structure of the excited states of hydrogen-like atoms, to study charge exchange collisions, to measure the fine structure in the excited states of complex atoms and to measure the lifetimes of atomic states.

This work is a continuation of that currently supported by NSF Grant PHY76-14857 A02.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0019, MOLECULAR BEAM, HYDROGEN MASER, AND STORED ATOM RESEARCH

N. Ramsey, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (PHY77-13938 A01)

High-precision molecular beam magnetic resonance apparatus will continue to be used to study internal orientation-dependent interactions in molecules, such as nuclear electric quadrupole, nuclear spin-rotational and spin-spin magnetic interactions. Primary emphasis will be on non-polar molecules. The dependence of the electric and magnetic susceptibilities on molecular orientation and rotational distortion parameters of molecules will also be studied. Measurements of similar orientation-dependent interactions in polar molecules will be studied with a new molecular beam electric resonance apparatus which combines an unusually high precision electric resonance apparatus with a strong magnetic field. Atomic hydrogen masers will be studied and improved. Major improvements can be expected for a large storage box hydrogen maser with deformable walls, which has just recently come into operation. Hydrogen masers will be used to obtain more accurate values of the hyperfine separation and the effect of an electric field upon the hyperfine separation. Experiments with other stored atoms will be carried out by various methods including the hydrogen maser spin exchange technique.

This work represents a continuation of that currently supported by Foundation grant MPS-7412429.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0020, MEASUREMENT OF TROPOSPHERIC UV FLUXES AS RELATED TO DEFINITION OF HYDROXYL FREE RADICAL ATMOSPHERIC CONCENTRATIONS

F.B. Sellers, Panametrics Inc., Radiation Physics, *221 Crescent St., Waltham, Massachusetts* 02154 (ATM76-23902 A01)

The GAMETAG program is providing the first set of coordinated measurements of trace atmospheric gases over a wide geographic area. Simultaneous solar UV fluxes are being measured for analysis of GAMETAG data by instruments provided and operated by Panametrics, Inc. These measurements and the subsequent data are crucial for calculations of photodissociation rates and excited species photoproduction rates, which are essential parameters for interpretation of GAMETAG results for concentrations of species such as OH and O3. This grant provides for continuation of the solar UV flux measurements and data reduction for the GAMETAG program. Downward fluxes in the 280-400 nm region are measured and reported in 10 bands varying from 2 t0 20 nm in width. Upward fluxes are measured with broad band Eppley pyranometers to assess effects of backscattered UV on photodissociation processes.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

8.0021, THEORETICAL STUDIES OF THE QUANTUM LIQUIDS AND SOLIDS

R.A. Guyer, University of Massachusetts, Amherst Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Amherst, Massachusetts* 01002 (DMR76-14447 A01)

Work begun under NSF grant DMR76-14447 will be continued and extended. Theoretical studies of quantum solids and fluids will be undertaken with special emphasis on helium-3 and helium-4. Magnetism in solid helium-3 will be investigated using the Heisenberg field approximation to calculate the magnetic and thermal properties. The current data base for solid helium-3 is not self-consistent at present and the source of this discrepancy will be sought. In another area, diffusion of the two-dimensional lattice gas for both helium-3 and helium-4 will be studied for comparison with experimental studies of monolayers adsorbed on grafoil. Problems of registry, vacancy tunneling, and phase transitions in monolayer systems will be investigated. A new area of research in the study of solitons and non-linear effects in quantum systems will be undertaken.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0022, THE ELECTRON G-FACTOR ANOMALY AND RELATED EXPERIMENTS

A. Rich, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Physics, *Ann Arbor, Michigan* 48104 (PHY77-26037)

This experiment uses the techniques of precise atomic metrology to measure a key fundamental property of an elementary particle (the electron) and its anti-particle (the positron). This is the measurement of the g-factor anomaly to an accuracy of 25 parts per billion. This will be a significant test of quantum electrodynamics and other fundamental physical theories. The method used is an extension of the Mott double-scattering technique. The anomaly is determined directly by observing the precision of the electron spin with respect to its velocity between

the two scatterings. A number of improvements have been incorporated in the experiment.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0023, NONCRYSTALLINE MAGNETIC MATERIALS
A.M. De Graaf, Wayne State University, School of Liberal Arts, Dept. of Physics, *4841 Cass Ave., Detroit, Michigan* 48202 (DMR78-08657)

Research previously supported under DMR76-17036.

Theoretical research in condensed matter physics will be carried out in order to study the properties of noncrystalline magnetic materials in general and those of cobalt and manganese aluminosilicate glasses in particular. In addition, several experiments on these glasses will be coordinated in cooperation with research groups at Wayne State University, the University of Sao Paulo and the University of Campinas. Various models of amorphous magnetism will be studied theoretically and compared with experimental results. This research will contribute to a deeper understanding of non-magnetic glasses, spin glasses, and other amorphous magnetic materials.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0024, THEORY OF SOLIDS AND LIQUIDS
J.W. Halley, University of Minnesota, Minneapolis Campus, School of Liberal Arts, Dept. of Physics & Astronomy, *322 Johnston Hall, Minneapolis, Minn* 55455 (DMR76-05186 A01)

Research previously supported by DMR76-05186.

Theoretical research in condensed matter physics will be carried out on a number of different topics, in order to enhance our understanding of the behavior of complex materials. These topics will include: (1) Magnetic systems, especially those which behave like one-and two-dimensional Heisenberg systems. Also, the dynamics of itinerant ferromagnets will be investigated. (2) Classical liquids, including the calculation of dynamical structure factors and depolarized light scattering. (3) Conductivity in disordered solids, particularly the use of percolation models and an analysis of metallic conductivity in the strong scattering limit.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0025, THERMALLY STIMULATED CURRENTS IN ALKALI-CONTAINING GLASSES
D.E. Day, University of Missouri, Rolla Campus, Center for Materials Research, *103 Parker Hall, Rolla, Missouri* 65401 (DMR77-13002)

This research will be an investigation of the storage and motion of electrical charge (polarization and conductivity) in alkali silicate glasses using thermally stimulated current (TSC) and ionic thermal current (ITC) techniques in order to obtain information about the nature of the alkali sites in vitreous solids. The study will investigate the localized sodium (Na) motion recently observed in a sodium silicate glass with these techniques, and which is currently attributed to the trapping of Na ions at the interface of immiscible phases, interfacial polarization, and to Na ion motion around the non-bridging oxygen ions, Na ion-(NBO)anion dipole polarization. The dependence of the parameters for this localized motion upon both glass composition and microstructure will be determined in order to evaluate those characteristics of the local alkali ion environment and glass microstructure which control short-range, and consequently, long-range alkali motion.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0026, MAGNETIC RESONANCE AND OTHER STUDIES AT LOW TEMPERATURES
R.E. Norberg, Washington University, School of Arts & Sciences, Dept. of Physics, *4559 Scott Ave., St. Louis, Missouri* 63130 (DMR78-10780)

This is a continuation of work sponsored under DMR-7618863. The diffusion and relaxation of dilute impurities of hydrogen and helium in simple solids and liquids will be measured. The Kapitza problem of energy transfer across a solid-liquid helium-II interface will be studied by means of measurements of phonon transmission and reflection. Metal hydrides will be studied by a method of hydrogen nuclear acoustic resonance. Defect controlled spin relaxation and ultra slow diffusion in solid krypton and krypton rare gas mixtures will be studied. Collective excitations in amorphous solids will be studied by magnetic specific heat at temperatures down to 100 mK. This work is important for understanding the nature of helium-II excitations at low temperature and the nature of diffusion in simple solids and liquids.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0027, THE STUDY OF VIBRATIONALLY EXCITED MOLECULES BY LOW-ENERGY ELECTRON SCATTERING
P.D. Burrow, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Lincoln, Nebraska* 68508 (ENG77-14649)

The research deals with the detection and study of vibrationally excited molecules by means of low-energy electron scattering techniques. Two methods for the determination of vibrational populations will be used and applied to excited nitrogen. Other electron impact processes with excited molecules will be investigated. Cross sections for collision processes such as ionization and dissociative attachment will be studied as a function of vibration content, for example, a study of the ionization of vibrationally excited nitrogen. New diagnostic techniques to examine the vibrational distribution of molecules will be developed. The production and deactivation of vibrationally excited molecules by collision with hot metal walls will be investigated. It appears that the numbers of collisions with a hot wall which are required before the vibrational temperature of a gas in contact with the wall reaches equilibrium with the wall temperature have not yet been determined quantitatively. Research will be initiated by using diagnostic techniques in conjunction with an oven source for vibrationally excited molecules. The oven will possess a simple tubular geometry with a variable length such that the number of wall collisions can be estimated with accuracy. The optical temperature of the oven and the vibrational distribution of the effusing molecules will be monitored. The research is a continuation of that done under NSF Grant No. ENG-7102472 AO1.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

8.0028, THEORETICAL STUDIES OF ATOMIC COLLISIONS
A. Halpern, City University of New York, Brooklyn College, School of Science, Dept. of Physics, *Bedford Ave. & Ave. H, Brooklyn, New York* 11210 (PHY78-11611)

Research in theoretical atomic physics will be initiated. Topics of interest include investigations of elastic scattering of charged particles by atoms, excitation of atoms and ions by electrons, protons, alpha particles, and other fully stripped atoms, atom-atom and ion-atom collisions, ionizing collisions, Glauber theory, and charge transfer collisions. The calculations are of both formal and practical interest in atomic physics. They will also be relevant to aspects of astrophysics and atmospheric physics, and to the plasma physics aspects of energy production and of nuclear pumped lasers.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0029, PHOTOSYNTHETIC PROCESS PROBED DIRECTLY WITH PICOSECOND LASER PULSES

R.R. Alfano, City University of New York, City College, School of Liberal Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (PCM77-14966 A01)

The understanding of the primary processes in photosynthesis has benefited greatly from direct picosecond kinetics measurements and studies in the picosecond fluorescence kinetics have opened a new era in photosynthesis research. Principally this project encompasses the systematic time dependent study of the kinetics, spectrum, and polarization of the subnanosecond fluorescent emmision and absorption difference from photosynthetic systems.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Biological Behavioral & Social Sciences, Div. of Physiology Cellular & Molecular Biology

8.0030, ELECTRON SPECTROMETRY OF SOLID SYSTEMS

J. Silcox, Cornell University, Ithaca Campus, School of Engineering, Dept. of Engineering & Applied Physics, *242 Carpenter Hall, Ithaca, New York* 14853 (DMR78-09204)

This is an extension of the research previously supported by DMR-7600834.

Experimental studies of the excitation spectra of solid state systems will be carried out using an electron microscope electron spectrometer system to measure inelastic electron scattering. A variable temperature stage will be used to monitor changes in phonon-electronic scattering terms in the multiple scattering. Single crystals of aluminum will be studied first with later extensions to metals with different screening radii. We expect data relevant to dynamical scattering effects to become available and propose detailed comparisons with existing calculations. Use of the variable temperature stage in studies dichalcogenide materials is proposed with particular concern for compounds of the form Nb1-xVxSe2, a search for two-dimensional electron gas behavior and dynamical scattering effects. One-dimensional materials will be explored when they become available at Cornell.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0031, PHOTOPION REACTIONS IN COMPLEX NUCLEI

J.E. Winhold, Rensselaer Polytechnic Inst., School of Science, Dept. of Physics, *110 8th, Troy, New York* 12181 (PHY77-09408 A01)

A program of photopion production studies at the Bates Linear Accelerator (MIT) will be continued in collaboration with Boston University and MIT. The program will emphasize observation of charged pions and measurement of differential cross sections for specific final nuclear states. Initially a low-energy pion spectrometer completed in 1976 will be used to cover a pion energy range from 10 to 45 MeV with 1 MeV energy resolution, extending recently published measurements on carbon-12 to a variety of other nuclei. Lithium-6, carbon-12, carbon-13 and oxygen-16 will be used as targets for studies of the production cross sections for positive and negative pions; searches will be made for production of giant multipole resonances, especially electric and magnetic dipole resonances; measurements will be made of pion production on very light nuclei, especially deuterium and helium-3. Towards the end of the three-year program it is hoped to initiate measurements with a new and larger spectrometer now being planned at MIT which will permit studies at higher energies.

Analysis of the data is expected to provide new insight into the interaction between pions and nuclei, and to provide new types of information concerning nuclear structure and transitions.

This work is a continuation of that performed under Foundation grant PHY76-14909.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0032, ULTRAHIGH FREQUENCY ABSORPTION AND NONLINEAR KAPITZA CONDUCTANCE MEASUREMENTS

J.H. Constable, State University of New York, Binghamton Campus, School of Arts & Sciences, Dept. of Physics, *Vestal Parkway, Binghamton, New York* 13901 (DMR76-11114 A01)

This is a continuation of work begun under DMR76-11114. The resonant absorption of orthohydrogen (oH2) and paradeuterium (pD2) impurities in parahydrogen (pH2), HD and orthodeuterium (oD2) host crystals will be measured in the ultrahigh frequency range and the absorption related to various anisotropic interactions such as the crystalline field. The importance of phonon attenuation and frequency conversion in the energy transport across a crystalline boundary will be assessed by studies of such effects near the boundaries of dielectric crystals.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0033, MAGNETIC RESONANCE PROPERTIES OF IONS IN NOBLE GAS LIQUIDS AND SOLIDS

J.F. Reichert, State University of New York, Buffalo Campus, School of Natural Sciences & Mathematics, Dept. of Physics, *3435 Main St., Buffalo, New York* 14214 (DMR78-23973)

This research is a continuation and extension of work sponsored under grant DMR7610135. Negative ions in liquid helium-3 constitute a unique, model system for studying, in depth, fundamental aspects of electron-nuclear, spin-spin interactions. Professor Reichert's recent experimental achievements in applying magnetic resonance techniques have resulted in the first experimental data suggesting the existence of a strong hyperfine coupling spin-lattice relaxation process in liquid helium-3. Techniques are now available to use this 'microscopic probe' of liquid helium-3 to study dynamic nuclear-polarization effects. Electron spin resonance and electron-nuclear double resonance techniques will be used to elucidate details pertaining to the fundamental nature of the hyperfine interaction. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0034, THEORETICAL STUDY OF SOLID ELECTROLYTES (SUPER-IONIC CONDUCTORS)

S. Choi, University of North Carolina, Chapel Hill Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Chapel Hill, North Carolina* 27514 (DMR7822207)

Solid electrolytes are interesting because one species of ions in the crystal tends to be disordered and liquid-like while other species remain in a crystalline framework. They have an abnormally high ionic electrical conductivity and other interesting properties such as varied phase transitions. For engineering applications, solid electrolytes are important because they may be used as an electrolyte in a battery, a fuel cell, or a heat-to-electricity converter. Although our understanding of most promising solid electrolytes such as beta-alumina and RbAg4I5 has made considerable progress, there are many phenomena and properties not well understood. Theoretical studies and numerical computations will be done on the equilibrium and transport properties of mixed (solid solution) beta-alumina, properties of charge compensating defects and impurities in beta-alumina, and the silver ion conduction in RbAg4K5. Classical many-body theories will be modified or improved, an also some numerical computation (such as the Monte Carlo method) will be done to enhance our understanding of the above mentioned properties and phenomena.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0035, ELECTRON AND PHONON INTERACTIONS IN METALS

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This is a continuation of research previously supported by NSF grant DMR-7600784.

Ultrasonic attenuation experiments will be done in ultra pure magnesium single crystals to determine the electronic contribution to the ultrasonic attenuation of longitudinal and shear waves. Doppler-shifted cyclotron resonance experiments will also be done in order to obtain information about electron life times and electron-phonon interactions. Realistic calculations of the magnetic field dependence of the attenuation in magnesium, cadmium, and zinc will be made using the Fermi surfaces of these metals based on band structure calculations. A transducerless electromagnetic generation and detection technique will be employed to study the Martensitic phase transformation in lithium six, lithium seven and sodium. This technique will also be used to study attenuation absorption edges in potassium. Phonon propagation characteristic studies in degenerate semiconductors will be continued in an attempt to obtain information about electron-phonon interactions and phonon mean free paths in these materials.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0036, ELECTRON PARAMAGNETIC RESONANCE CHARACTERIZATION AND MONITORING OF SILICON DETECTOR MATERIALS

G.K. Miner, University of Dayton, School of Arts & Sciences, Dept. of Physics, *300 College Park Ave., Dayton, Ohio* 45469 (DF055040; AFOSR-79-0108)

AF function - microwave solid state electronic devices are essential components of Air Force surveillance, electronic countermeasures and communication systems. The development of silicon based infrared detector material is dependent upon the knowledge and control of dopants and impurities. Opportunity - this research should improve the ability to develop detectors for the 3-5 micron range and large detector arrays. Objective - the objective of this research is to characterize and monitor impurities and dopants in silicon detector materials. How work contributes - this work will provide feedback to establish crystal growth conditions to improve silicon detector materials.

X-level samples and neutron transmutation doped samples will be examined with x-band spectrometer. Dangling bond observations will be attempted. K-band and dispersion modes will be employed for general study of defects.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0037, MAGNETIC RESONANCE STUDIES OF DEFECT BEHAVIOR IN PEROVSKITE AND RUTILE STRUCTURED MATERIALS

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This research was previously supported under DMR 73-07656.

The principal goal of this research program is to determine the formation mechanisms and resulting electronic structure of defects in perovskite and rutile structured halides. Specifically, the self-trapped exciton triplet states in KMgF3 and MgF2 will be investigated by combining optical and magnetic resonance techniques. The results of these experiments will provide a better understanding of the photochemical damage process in low-symmetry materials. The second area of investigation will be the magneto optic properties of luminescing Mn2 ion-F center exchange coupled close pairs in KMgF3. Finally, electron-nuclear double resonance (ENDOR) studies of the self-trapped hole and the impurity-associated fluorine interstitial centers in KMgF3 will be continued, as well as extension of this work to an electron spin resonance (ESR) investigation of interstitial centers in RbCaF3.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0038, STUDY OF ELECTRON IMPACT OF LASER MEDIA WITH EMPHASIS ON THE ROLE OF TEMPORARY NEGATIVE ION FORMATION

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This experimental program is aimed at the measurement of the basic parameters necessary for the design of laser pumped by electron impact. The researchers will measure electron impact excitation cross sections, optical branching ratios of the subsequent decays, excited state lifetimes, polarization of the radiation, and collisional deactivation decay and energy transfer rates in the case of metastable excitation for a number of target atoms and molecules. The measurements will be performed at sufficient electron energy resolution so that particular attention can be directed towards the role of resonances in the excitation process. The experimental design is such that high energy resolution measurements can be performed with sensitivities much larger (by more than a factor of 5000 in some cases) than previously thought possible. This is a continuation of research previously supported under NSF grant ENG-7523512.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Engineering & Applied Science, Div. of Electrical Computer & Systems Engineering

8.0039, ELECTRONIC STRUCTURE AND SPIN-RESOLVED K-SPACE SPECTROSCOPY IN METALS

D.H. Lowndes, Oregon State Higher Education System, University of Oregon, School of Liberal Arts, Dept. of Physics, *1472 Kincaid St., Eugene, Oregon* 97401 (DMR78-06271)

This research was previously supported under DMR-7407652.

Improved resolution of the de Haas-van Alphen technique will be used in studies of electronic structure in a variety of metals. These studies include an investigation of the onset of ferromagnetism in a metal with dilute magnetic impurities; an investigation of the connection between the electronic structure and the A-15 structural phase transition in superconducting Nb3Sn and V3Si; and an investigation of the electronic structure in the La(Gd,Ce)Al2 system in which superconductivity may coexist with a magnetic state. Experiments will also be carried out in single crystals of mercury to investigate the quenching of the electron-phonon mass enhancement by an intense magnetic field. Large magnetic field-dependent increases in electron-impurity scattering will be studied by examination of the line shape from single quantum oscillations. Experiments will be continued to investigate the combined effects of Fermi surface geometry and the spin-orbit interaction in order to understand the origin of large shifts in the electronic g-factor.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0040, THERMODYNAMICS AND STATISTICAL MECHANICS OF PHASE TRANSITIONS

R.B. Griffiths, Carnegie Mellon University, Mellon Inst. of Science, Dept. of Physics, *4400 5th Ave., Pittsburgh, Pennsylvania* 15213 (DMR78-20394)

Research previously supported by DMR7623071. The following topics in the general area of phase transitions and critical phenomena will be investigated: 1. A thermodynamic model of a tricritical point in a particular mixture will be constructed in order to assist some research groups which are studying light scattering in this mixture and to test for the presence of expected logarithmic corrections to the thermodynamic properties. 2. The possible utility of the mathematical discipline of Catastro-

phe Theory for classifying multicritical points will be investigated, with special reference to multicritical points in liquid mixtures. 3. Theoretical models will be constructed in an effort to understand the phase transitions which occur when noble gases are adsorbed on a graphite substrate. Of particular interest are the first-order transitions observed as single layers are added to the substrate, and the various transitions which occur below or near a coverage of one layer. 4. Previous research has indicated that real-space renormalization-group methods, which are widely used for certain problems in statistical mechanics, suffer from certain mathematical difficulties. The study of these difficulties will continue. 5. Mathematical models will be constructed for various non-linear processes which occur during first-order phase transitions, such as dendritic growth of crystals.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0041, SURFACE QUANTIZATION AND ELECTRON-ELECTRON INTERACTIONS

P.J. Stiles, Brown University, Graduate School, Dept. of Physics, *University Hall, Box 1843, Providence, Rhode Island* 02912 (DMR77-10218 A01)

Experimental studies of the electronic transport properties of inversion and accumulation layers in semiconductors will be continued. This is an extension of research previously supported by NSF grant DMR-7302401. Measurements of the magnetoconductivity, Shubnikov-de Haas effect, cyclotron resonance will be used to investigate the one-electron states as well as the one-electron and many-electron excitations of the quasi-two-dimensional (Q2D) electron gas localized at the interface between silicon and silicon dioxide. Specific topics to be addressed include: the formation of superlattices in Q2D systems; measurement of Q2D plasmons; electron-phonon interactions in Q2D electron systems; and the localization of electronic states due to potential fluctuations.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0042, MAGNETIC EFFECTS IN POLYATOMIC GASES AND AMORPHOUS METALS

T.W. Adair, Texas A & M University, College Station Campus, School of Science, Dept. of Physics, *College Station, Texas* 77843 (A-288)

The thermomagnetic torque (TMT) has been measured in nitrogen-helium gas mixtures at room temperature. The TMT in nitrogen gas is the result of non-spherical non-spherical particle interaction. By adding helium to the nitrogen gas an additional contribution is observed due to the non-spherical spherical particle interaction. This interaction has been studied by varying the helium concentration in the mixture and measuring the change in the characteristic maximum magnetic field-pressure ratio, (H/p)max and the maximum torque times pressure divided by the temperature difference, (P/delta T)max. As the helium concentration has increased the value (H/p)max was found to decrease linearly. The maximum value of (P/delta T) max was observed at concentration of 50% helium. Hall coefficient measurements for the amorphous transition metal alloy La8Ga2 have been obtained at LHe, LN2 and room temperatures. Rh varies from plus 8.9 at room temperature to plus 11 at 4.2K in units of 10 to the minus 11th power cu. m/As. The values of Rh are consistent with the literature value for the pure liquid metal in contrast to the literature value of minus 8.9 for crystalline dhcp La.

SUPPORTED BY Robert A. Welch Foundation

8.0043, ATOMIC AND MOLECULAR PROCESSES

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Charge transfer reactions of the type, A plus q plus B yields A(plus q minus 1) plus B may leave the A(plus q minus 1) ion in a highly excited electronic state. This excited state may in some cases radiate to a lower state with the emission of VUV or X-ray photons. If the cross section for charge transfer is large, a population inversion and a potential X-ray laser may result.

The system He ions plus Li yields He ion plus Li ion colliding at low energy has been found by ab initio computations to preferentially produce He ion (3l) which may decay either by the emisson of 256A photons or by a cascade of 1640A and 304A photons. At low relative collision velocities, v approximately 0.5 x 10 to the 8th power sq. cm/sec, cross-sections of sigma approximately 10 to the minus 15th power sq. cm for the production of He ion (3l) are found. At larger velocities, v greater than 2 x 10 to the 8th power cm/sec, the ionization reaction A plus q plus B yields A(plus q minus 1) plus B ions plus e predominates thus destroying the possibility of population inversion on an excited electronic state. A principal significance of this work is its narrowing of a large and very difficult experimental domain. Experimental validation of this potential population inversion is needed.

SUPPORTED BY Robert A. Welch Foundation

8.0044, THEORETICAL-NUMERICAL STUDIES OF PHYSISORPTION AND OTHER PROPERTIES OF CRYSTALLINE SURFACES

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In our continuing studies of dynamical and related properties of ionic crystal surfaces we have completed the calculation of the infrared absorption properties of microcrystals of MgO. We found close agreement between the main infrared absorption frequency omega m of these near-cubical clusters of the Frohlich frequency omega P of the continuum theory of infrared absorption in small spheres; the size dependence of the calculated absorption spectrum appears to agree quite well with experimentally observed absorption spectra.

A collaborative effort has been initiated with scientists of the Max-Planck Institut fur Festkorperforschung, Stuttgart, West Germany, to study and develop shell models describing ionic interactions near the surfaces of ionic crystals. The aim is to arrive at models that will: (1) describe the bulk properties properly, and (2) allow the simultaneous calculation of surface structural and surface dynamical properties. Such models are of particular importance for the description of surface properties of crystals containing O ions (such as MgO). The free O ions seem to be unstable, and in crystalline environments its polarizability is proportional to the ionic volume. Hence variable anion polarizability (and possible charge transfer near the surface) has to be taken into account in the modified shell models.

SUPPORTED BY Robert A. Welch Foundation

8.0045, ULTRASOUND STUDIES OF CONCENTRATION OR CRITICAL FLUCTUATIONS IN LIQUID BINARY SYSTEMS WHICH EXHIBIT A METAL-NON-METAL TRANSITION

D.E. Bowen, University of Texas, El Paso Campus, School of Liberal Arts, Dept. of Physics, *El Paso, Texas* 79902 (DMR78-08494)

The broad goal of this work is to understand what factors govern the transition of a substance from a conducting state at higher temperatures to a non-conducting state at a lower temperature. This transition is called a metal-nonmetal (MNM) transition and is of broad interest in condensed matter science. The attenuation and velocity of ultrasound through solutions of alkali metals in liquid ammonia are measured as functions of temperature near the critical point. The data are analyzed using Fixman-Kawasaki theory to infer correlation lengths and, perhaps, scaling parameters.

This is a continuation of work supported under DMR 75-23652.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0046, LOCALIZED AND COLLECTIVE EXCITATION AND ORDERING PROCESSES IN IONIC CRYSTALS
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Research previously supported by DMR74-13870.

The investigations will cover a variety of systems with the purpose of establishing interconnections between localized defect and collective crystal behavior. (1) Molecular and off-center paraelectric defects will be investigated. Particular emphasis will be on studies of these systems under hydrostatic pressure. The close similarities of the pressure-induced transitions to the behavior of displacive ferroelectrics will be explored. (2) Mixed alkali-halide-cyanide crystals of the type KBr1-x(CN)x will be studied by means of Raman, optical and dielectric techniques. (3) Resonance Raman scattering and hot luminescence effects of F-center defects will be carried out. The systems to be studied will include hydrogen defects in alkali-halides. The motivation of this work, besides the fundamental interest in the interrelation of the resonance scattering process, will be the potential of these systems for broadly tunable IR laser application.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0047, ELECTRONIC PROPERTIES OF METALS AND ALLOYS IN HIGH MAGNETIC FIELDS
R.V. Coleman, University of Virginia, School of Arts & Sciences, Dept. of Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (DMR78-02553)

The electronic structure and properties of layer crystals exhibiting charge density wave (CDW) transitions will be investigated experimentally. Measurements of quantum oscillatory phenomena at high magnetic fields will be made on single crystals of layer structure dichalcogenides and trichalcogenides. DC transport measurements including Hall effect, magnetoresistance and superconducting anisotropy will also be carried out. Both Shubnikov de Haas and de Haas van Alphen oscillations will be measured using AC modulation and harmonic detection. These techniques are being extended for use on the high field Bitter solenoids at the National Magnet Laboratory. Charge density wave formation in the chalcogenides will be studied and the effects of organic intercalation and pressure on the CDW will be followed by measuring the quantum oscillatory phenomena. DC susceptibility, Hall effect and magnetoresistance as a function of temperature will also be used to correlate results with CDW formation.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0048, DISLOCATION DYNAMICS
J.W. Mitchell, University of Virginia, School of Arts & Sciences, Dept. of Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (DMR77-26168)

This is a continuation of a fundamental investigation on the motion of high velocity dislocations in solids. The objective is to understand the origins of resistance to the motion of individual dislocations from a theoretical and experimental point of view. Studies on Cu-Ni-Pd-Al alloys which have relatively high yield points due to solute segregation at residual dislocations, and yet have an apparent low fractional resistance to dislocation motion will be continued. The dislocation velocities as a function of temperature (4.2 degrees to 300 degrees K) and applied stress will be determined for single crystals of these alloys, as well as for single crystals of Cu-Ni and Cu-Al-Ni alloys surface hardened by diffusion of Pd into the surface layers. Supplementary studies required to establish the detailed dislocation mechanisms of the relaxation processes will be done. Current research on the lattice dynamical theory of dislocation motion will be continued with particular emphasis on the velocity range half the speed of sound, where low stress long-range motion of straight dislocations has been shown to occur in simple lattice models. In addition, a detailed study of the interaction of moving dislocations with phonons, with the aim of establishing a theory of the temperature dependence of dislocation mobility will be undertaken, and will include the effect of dispersed impurities in a non-dilute alloy. Lastly, theoretical studies on the propagation of dislocation avalanches and microcracks will be undertaken. This is a continuation of research, previously funded under NSF Grant DMR76-01059. This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0049, X-RAY ABSORPTION SPECTROSCOPIC INVESTIGATION OF THE STRUCTURE OF NON-CRYSTALLINE SURFACE LAYERS
F.W. Lytle, Boeing Engineering & Construction Co., *Seattle, Washington* 98124 (DMR77-12919 A01)

This research will be a study of the structure of surface oxide layers on metals such as titanium, aluminum and tantalum using Extended X-ray Absorption Fine Structure (EXAFS) experiments at the Standard Synchrotron Radiation Project. Determination of the structure and energy position of the absorption edges will yield information about the orbitals of chemical bonding and ionicity of the bonds. The EXAFS spectra will be analyzed to determine the number, distance and type of coordinating atoms surrounding the adsorbing atom.

The aim is to understand the interatomic relationships between the metal and oxide, hydroxide or other anions from the anodizing solution. Such information has not been possible in the past and may reflect on common usage of these materials varying from structural applications, protective finishes, and dielectric strength to fuel cells, electrode processes and exo-electron emission.

This is a continuation of research initiated under NSF Grant DMR74-24261 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0050, SKIN ALIGNED ATOMIC HYDROGEN
O.E. Vilches, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (DMR77-27528)

An experimental study will be made of the production, storage, and thermodynamic properties of spin polarized atomic hydrogen and its isotopes in their three dimensional bulk forms and as absorbed films. The prediction that at all temperatures spin polarized atomic hydrogen is gas which shows strong quantum effects will be tested. Further, the prediction that for spin polarized deuterium the liquid and vapor phases coexist to the lowest available temperature will be tested.

This is the first year of a two-year continuing grant.

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Directorate for Mathematical & Physical Sciences, Div. of Materials Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, STABLE FREQUENCY SOURCE UTILIZING A SUPERCONDUCTING-CAVITY-STABILIZED OSCILLATOR
M.H. Cohen, California Inst. of Technology, Graduate School, Dept. of Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (AST76-23634)

Very long base line interferometry (VLBI) is the technique in which two radiotelescopes thousands of miles apart can be used together to resolve the finest details of distant radio sources. This is done by recording the signals from the separate telescopes along with timing information from a highly accurate clock and later playing back both tapes into a special processor. The success of the method depends upon the accuracy of the clocks at each telescope. Until now most telescopes have used hydrogen maser time standards which are quite expensive. A

new type of standard based on a superconducting cavity stabilized oscillator will be developed for use at the Owens Valley Radio Observatory of the California Institute of Technology which does not have a hydrogen maser. The new standard will greatly improve the stability and sensitivity of VLBI observations made at the observatory and will be available to all qualified users.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0002, OBSERVATIONAL STUDIES IN GALACTIC AND EXTRAGALACTIC ASTROPHYSICS

B.T. Soifer, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (AST7682890A02)

Infrared spectrophotometric observations of galactic and extragalactic sources will be carried out. The UCSD-U. Minn. Mt. Lemmon Observatory and the 3-m telescope of Lick Observatory will be used. Necessary improvements will be made in the multi-detector, grating spectrometer in order to increase the ultimate sensitivity of infrared spectroscopy.

The infrared observations will consist of moderate resolution lambda/delta 70) spectrophotometry from 2 to 4 and 8 to 13 microns. Galactic sources to be studied are those that might exhibit the unidentified spectral features discovered in NGC 7027, newly discovered sources, and chemically peculiar stars. Extragalactic sources to be studied include some of the brightest quasistellar objects in which optical emission lines are redshifted into the 2 micron window. A few of the brightest infrared galaxies will also be observed.

In developing the grating spectrometer, the aim is to build the most efficient instrument possible and to test and demonstrate its performance. The use of an up-looking configuration, Fabry field optics, and the best demonstrated photoconductors were dictated by this aim. They shall test the spectrometer on the Mt. Lemmon telescope, make any necessary improvements, test and improve the data acquisition and reduction techniques, and use the system for useful astronomical observations.

This is a continuation of AST-7682890.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0003, A SPECTROSCOPIC STUDY OF O-TYPE STARS

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Support is for a program of spectroscopic research on the O-type stars, the hottest, brightest, and most massive of all stars. These stars must be very young on a cosmic time scale since they pour out energy at so large a rate (100,000 to one million times the luminosity of the sun). They ionize the immediate stellar neighborhood; and their presence is important for the formation and early evolution of other nearby stars. All O-type stars lose mass, for the hottest ones, at such a rate that the outer atmosphere of the star is substantially modified. This 'stellar wind' also influences the immediate surrounding and affects the subsequent evolution of the O-type star itself.

Spectroscopic observations of O-type stars will be obtained in two areas. The first is to study phenomena in the stellar winds as evidenced by the emission and absorption line profiles, as points of contact with the theory of expanding and extending atmospheres. This will permit specific statements about the mass-loss mechanism and the physical phenomena observed in the stellar winds. The second aspect will be to determine stellar masses by investigations of O-type binary stars. It is suggested that O stars with masses up to 100 times that of the sun may exist, but only binary stars can give directly derived numbers. The determination of the fundamental parameter of stellar mass has overriding importance in the understanding of the evolution of these very luminous stars.

Prior support was by NSF grant AST76-20842 A01.

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Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0004, SOLAR WIND STUDIES USING THE COCOA CROSS RADIOTELESCOPE

W.M. Cronyn, University of Iowa, School of Liberal Arts, Dept. of Physics & Astronomy, *Jessup Hall, Iowa City, Iowa* 52240 (ATM77-27530)

The solar terrestrial research program to study dynamic solar wind features associated with, and delineated by interplanetary scintillation (IPS) activity of natural radio sources, using the University of Iowa Cocoa Cross radiotelescope is to be continued. Its operating frequency and large electronically steerable collecting area make it possible to take daily synoptic measurements of scintillation index and spectra on far more sources over a larger range of ecliptic coordination than would be possible with any other telescope in the world.

Utilizing a numerical modeling code and recently installed digital data acquisition systems, it should be possible to deduce estimates of distance, velocity and electron density power spectrum (including power law index). Correlation with in situ spacecraft measures will continue with detailed analysis of events to deduce the shape and extent of the irregularity structures in and out of the ecliptic plane. The occurrence and physical characteristics of the plasma turbulence which gives rise to IPS will be studied on time scales of 27 days, 1 day and less than 1 minute to study streams, transient fast-moving plasmoids and shock fronts and associations with solar phenomena.

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Directorate for Astronomical
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of Atmospheric Sciences

10.0005, A LABORATORY EXPERIMENT OF AN IONOSPHERIC INTEREST - MICROWAVE SCATTERING BY A SYSTEM OF PLASMA WAVES OR IRREGULARITIES

N. D'Angelo, University of Iowa, School of Liberal Arts, Dept. of Physics & Astronomy, *Jessup Hall, Iowa City, Iowa* 52240 (ATM78-00529)

A process of cosmic noise absorption (CNA), involving backscatter of 20-30 MHz electromagnetic radiation of cosmic origin by E region plasma waves, has been recently suggested. The relevant E region plasma waves are produced by the Farley-Buneman instability, which is excited by large ionospheric electric fields.

This grant funds studies in the laboratory, in a multidipole plasma device, of the scattering of electromagnetic radiation (3 cm mu waves) by systems of Farley-Buneman waves. Scattering cross-sections will be measured for a given level of Farley-Buneman turbulence. This will then be compared to theory to test its validity and/or seek improvements therein.

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Directorate for Astronomical
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of Atmospheric Sciences

10.0006, INVESTIGATION OF A GROUP OF DENSE ROTATING INTERSTELLAR CLOUDS WHICH ARE UNDERGOING EXTENSIVE FRAGMENTATION

F.O. Clark, University of Kentucky, College of Arts & Sciences, Dept. of Physics & Astronomy, *Limestone & Euclid, Lexington, Kentucky* 40506 (AST76-80200 A01)

In the Taurus region of the sky there is a group of interstellar gas clouds which are rotating, extensively fragmented, and probably in a state of gravitational collapse. These clouds will be studied by means of the microwave spectral lines of the common interstellar molecules formaldehyde, hydroxyl radical, and carbon monoxide. The study will determine the physical parameters of these clouds, such as kinetic temperature, density and density gradient, kinematics (rotation, fragmentation, and other measurable motions), and possibly also chemistry. The study will establish the details of rotation and fragmentation for

this group of interstellar clouds, and demonstrate how the collapse motions are consistent with the conservation of angular momentum. The results will be useful for understanding how these processes actually take place and will provide an observational basis for theoretical calculations of realistic models which include rotation. The study is based on preliminary results which show unexpected detailed fragmentation taking place.

This is a continuation of work done under grant AST 76-80200.

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Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0007, RADIO CORONAL HOLES AND GEOMAGNETIC DISTURBANCES

M.D. Papagiannis, Boston University, Graduate School, Dept. of Astronomy, *705 Commonwealth Ave., Boston, Massachusetts* 02215 (DF249650; F19628-77-C-0189)

AF function - communications and navigation. Deficiency - radio signal fading and changes in satellite orbit ephemerides. Objective -to determine the relationship between solar coronal hole radio parameters and the magnitude of terrestrial magnetic disturbances initiated by the high speed wind streams from the holes. How research contributes -defines those radio coronal hole parameters that are operationally significant in forecasting the occurrence and severity of geomagnetic disturbances.

Archival radioheliograms obtained with moderate resolution radiotelescopes in the United States and Brazil at wavelengths from 21 cm to 0.12 cm will be examined and scaled for coronal hole data. Spectral characteristics of the radio coronal hole will be compared with solar wind and geomagnetic data to establish operational forecast parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

10.0008, RADIO ASTRONOMY AT THE HAYSTACK OBSERVATORY

P.B. Sebring, Northeast Radio Observ. Corp., *Cambridge, Massachusetts* 01886 (AST75-14701 A03)

The Haystack Observatory will provide a radio astronomy observing facility available to all U.S. astronomers and easily accessible to radio astronomy groups based in New England. A great deal of research in the coming year will center around programs aimed at understanding the characteristics of molecules found in interstellar space and their relationship to clouds of dust and hydrogen gas out of which stars are being formed. Molecules to be considered include water, methanol and ammonia.

A considerable amount of effort will be devoted to Very Long Baseline Interferometry. This work involves worldwide cooperative projects and now provides the highest resolution and most accurate positional measurements in astronomy. One-fourth of the radio observing time will be used for this type of work.

This is a continuation of support under NSF Grant AST 75-14701.

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Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0009, ASTROPHYSICAL FLUID DYNAMIC STUDIES

R.F. Stein, Michigan State University, School of Natural Sciences, Dept. of Astronomy & Astrophysics, *243 Natural Resources Bldg., East Lansing, Michigan* 48824 (AST76-22479 A01)

Techniques for solving coupled radiative transfer-nonlinear fluid flow problems in one dimension and nonlinear fluid flow problems in two and three dimensions will be developed and used to study interrelated solar problems: 1) The generation of acoustic and magnetic waves by nonlinear interaction with turbulent motions and by overstability due to interaction with the radiative flux. 2) The deposition of energy and momentum in the chromosphere and corona. The goal is to develop tools for analyzing observed solar waves and models of the energy balance in the chromosphere and corona with heating by magnetic, acoustic, and gravity waves. Once a self-consistent solar model is constructed, the same techniques will be applied to other stars where chromospheres and coronas are observed.

Also, accretion onto protostars and the formation of compact H II regions in the dense circumstellar cloud will be studied through the calculation of theoretical models of the evolution of compact H II regions to use with infrared and radio observations to analyze conditions of star formation.

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Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0010, TWO-DIMENSIONAL CLASSIFICATION OF STARS SOUTH OF PLUS 20 DEGREES IN THE HENRY DRAPER CATALOGUE

C.R. Cowley, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Astronomy, *Ann Arbor, Michigan* 48104 (AST77-27744)

This project will continue two-dimensional spectral classification of the southern stars of the Henry Draper catalogue. The spectra are on high-quality objective-prism plates taken with the Michigan Curtis Schmidt telescope located at the Cerro Tololo Inter-American Observatory in Chile. Volume 1, containing 36,000 stars between declinations of 90 degrees and minus 53 degrees was published in 1975, and Volume 2, containing 31,000 stars between declinations between minus 53 degrees and minus 40 degrees is now being prepared for publication.

During the two-year period of this grant it is expected that Volume 3 (containing classifications of about 32,000 stars) will be started. Also, the remaining plates for regions accessible rom Cerro Tololo will be obtained. In addition some combined statistical analyses of Volume 1 and 2 will be made, and lists of stars of special interest will be published.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0011, SPECTROSCOPY OF FAINT SOURCES

A. Sletteback, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Astronomy, *164 W. 17th Ave., Columbus, Ohio* 43210 (AST77-26890)

Observations with an image-dissector scanner attached to a Cassegrain spectrograph on the Perkins 72-inch telescope in Flagstaff, Arizona, will be made of objects identified by means of three independent deep-sky surveys: (1) the Steward Observatory Near-Infrared Photographic Sky Survey, (2) Dr. A. A. Hoag's lists of faint objects with peculiar emission, obtained through the use of transmission-grating slitless spectroscopy, and (3) the Ohio State University Radio Observatory lists of radio sources. Many different kinds of objects, both galactic and extragalactic, have been and are being detected by these surveys and will be studied spectroscopically with the image-dissector scanner. These observations are expected to help provide a better understanding of the galactic structure and the morphology of external systems.

This grant will provide funds for the acquisition of a minicomputer at the Ohio State University for data reduction and software development, and for travel to make the necessary observations.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0012, EXTRAGALACTIC AND SOLAR SYSTEM RADIO ASTRONOMY

J.N. Douglas, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST77-28477)

A program of extragalactic radio astronomy will be carried out in three main phases: 1. Continuation of the Texas Sky

Survey. Accurate (plus or minus 1') positions, flux density structure and variability data are being obtained at 380 and 335 MHz for all sources north of minus 35 degrees declination and brighter than 0.25 Jansky (about 50,000 sources). Basic observations will be 95 per cent complete and one-third of the data will have been reduced to publishable form by the spring of 1979. 2. Identification of radio sources from the survey with optical objects from the National Geographical Society - Palomar Sky Survey, using our accurate radio positions and accurate optical positions measured with our computer-interactive laser measuring engine. Experience to date shows about 45 per cent of radio sources to have optical counterparts within 5', having an identification reliability higher than 90 per cent. The entire survey is thus expected to produce about 22,000 optical identifications, an order-of-magnitude increase over what is now available in the literature. 3. Spectroscopic and photometric observations of selected large samples of the identifications are carried out at McDonald Observatory by Drs. Derek and Beverly Wills.

Supplementary programs in instrumentation and synoptic monitoring of Jupiter will also be carried out. This is a continuation of research done under AST 76-01883 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0013, GALACTIC ABUNDANCES OF THE CHEMICAL ELEMENTS

P.A. Vanden Bout, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (F-623)

Radio frequency studies of galactic molecular clouds have been made to investigate the effects of chemical reactions on the relative abundances of different isotopic species of interstellar molecules. Knowledge of the effects is necessary if correct relative abundances of nuclear isotopes are to be obtained from astronomical observations of molecular spectral lines. Work has concentrated on deuterated molecules. Interstellar deuterium isocyanide, DNC, was discovered by observing its J equals 2-1 rotational transition at 152.60977 GHz. Measurements of the (DNC/HNC) ratio in a variety of molecular clouds are correlated with cloud kinetic temperatuse and indicate that the deuteration of HNC proceeds via exchange reactions between HD and a molecular ion. Observations of HCO ion and DCO ion have been made and analyzed to put limits on the abundance of free electrons in galactic molecular clouds. Results are consistent with the abundances necessary for gas-phase ionmolecule chemistry to operate.

Optical wavelength sppctroscopy of interstellar atoms has been continued with the detection of lithium 6708 A toward an additional two stars, bringing the total number of interstellar clouds in which lithium abundances can be studied to six.

SUPPORTED BY Robert A. Welch Foundation

10.0014, DEVELOPMENT OF INFRARED ARRAY SPECTROMETER SYSTEMS

R.D. Gehrz, University of Wyoming, School of Arts & Sciences, Dept. of Physics, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (AST76-05039 A02)

Observations at infrared wavelengths in combination with radio, millimeter and optical studies are rapidly adding to our knowledge of a variety of objects in the universe. An array of six infrared detectors has been used to improve the efficiency of observing the inherently weak infrared signals.

A program of further development of array detectors on spectrometer systems will be carried out. The number of detectors will be increased and the wavelength coverage will be expanded. The resulting instruments will be tested at Kitt Peak National Observatory and will be the main auxiliary instruments to be used on the University of Wyoming 90-inch infrared telescope.

This is a continuation of work currently supported under NSF grant AST 76-05039 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0015, SPACECRAFT CHARGING STUDIES IN EUROPE

G.L. Wrenn, University of London, University College, Mullard Space Science Lab., *Dorking, England, United Kingdom* (DF289750; AFOSR-78-3713)

AF function - space system survivability by control or elimination of differential spacecraft charging effects. Deficiency - a comprehensive knowledge of European capabilities in spacecraft charging technology would enable the USAF to fully capitalize on advances in this field by European R&D organizations. Research - this effort will complement AFGL, AFOSR, AFML and SAMSO programs to understand the spacecraft charging phenomena and to control or eliminate its effects on USAF and DOD space systems. Research will investigate European advances in this field and assess applications possibilities for lengthening the lifetimes of space systems. How research contributes - research will enable AFGL to incorporate the latest European advances in spacecraft charging technology to the SCATHA satellite program and to obtain more accurate knowledge of the space environment in which space systems operate.

An internationally respected authority in space physics will conduct an assessment of European capabilities in the field for further examination and application by AFGL space environment experts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, European
Office of Aerospace Research &
Development

VOLUME 18 NUMBER 18/SEPTEMBER 23, 1980

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N80-27273# Battelle Columbus Labs., Ohio.
THE GENERAL AVIATION DYNAMICS MODEL. VOLUME 1: EXECUTIVE SUMMARY Final Report, 2 Sep. 1977 - 30 May 1979
Michael A. Duffy and Jane H. McCreery 30 May 1979 31 p
(Contract DOT-FA77WA-4043)
(AD-A073543; FAA-AVP-79-8-Vol-1) Avail: NTIS
HC A03/MF A01 CSCL 01/2

A brief non-technical overview of the General Aviation Dynamics model, an evaluation of its first post-sample period forecast, and a discussion of some of its more recent applications are given. The model is a dynamic simulation, interactive computer model built upon the cause-effect interactions displayed between various sectors of the general aviation system. GRA

N80-27274# Battelle Columbus Labs., Ohio.
THE GENERAL AVIATION DYNAMIC MODEL. VOLUME 2: TECHNICAL REPORT Final Report, 2 Sep. 1977 - 30 May 1979
Michael A. Duffy and Jane H. McCreery 30 May 1979 169 p refs
(Contract DOT-FA77WA-4043)
(AD-A073544; FAA-AVP-79-8-Vol-2) Avail: NTIS
HC A08/MF A01 CSCL 01/2

A detailed description of the General Aviation Dynamics (GAD) model is given. It contains a complete set of statistics, including actual data, for the estimated causal relationships within each sector of the model. Also illustrated is how the GAD model can be used to evaluate alternative policy actions. The model is a dynamic simulation, interactive computer model built upon the cause-effect interactions displayed between various sectors of the general aviation system. GRA

N80-27275# Federal Aviation Administration, Washington, D. C. Office of Aviation Policy.
FAA AVIATION FORECASTINGS, FISCAL YEARS 1980 - 1991
Sep. 1979 91 p
(AD-A075382; FAA-AVP-79-9) Avail: NTIS
HC A05/MF A01 CSCL 01/2

The Official Federal Aviation Administration (FAA) forecasts of domestic aviation activity for the years 1980 to 1991 are presented in this volume. It contains forecasts of aviation activity at FAA towered airports and Air Route Traffic Control Centers, as well as services provided by flight service stations. Aviation activity forecasts for the four major users of the National Airspace System, the trunk and local air carriers, the air taxi and commuter air carriers, general aviation, and the military, also are presented. GRA

N80-27276# Transportation Systems Center, Cambridge, Mass.
GENERAL AVIATION PILOT AND AIRCRAFT ACTIVITY SURVEY, CONDUCTED IN 1978
Susan J. Pinciaro Dec. 1979 52 p refs
(AD-A081726; TSC-FAA-79-29; FAA-MS-79-7) Avail: NTIS
HC A04/MF A01 CSCL 01/2

This report provides a summary and analysis of the data collected in the 1978 General Aviation Pilot and Aircraft Activity Survey. The survey was conducted at a random sample of airports across the nation and Puerto Rico, throughout the months of July and August 1978, by the Federal Aviation Administration with the assistance of the Civil Air Patrol. The survey data provide information regarding the magnitude and characteristics of general aviation including: type and source of aircraft, flight purpose, utilization of flight plan and weather information services, trip length in time and distance, pilot age and certification. Estimates are made of total 1978 general aviation operations, fuel consumption and aircraft miles flown. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-27277 Pennsylvania State Univ., University Park.
A NUMERICAL AND EXPERIMENTAL STUDY OF THE TURBULENT WAKES OF TURBOMACHINERY ROTOR BLADES, ISOLATED AIRFOILS, AND A CASCADE OF AIRFOILS Ph.D. Thesis
Chunill Hah 1980 341 p
Avail: Univ. Microfilms Order No. 8015798

Three turbulence models were employed to obtain closure of the governing equations. The first model was comprised of transport equations for the turbulent kinetic energy and the rate of energy dissipation, and the second and third models were comprised of equations for the rate of turbulent kinetic energy dissipation and Reynolds stresses, respectively. The second model handles the convection and diffusion terms in the Reynolds stress transport equation collectively, while the third model handles them individually. All three models were modified for the effect of streamline curvature. The rotation originated redistribution terms were added in the transport equation of Reynolds stresses of the second and third models. The turbulent wakes of an isolated airfoil and a cascade of airfoils are handled as simpler cases of the general rotating three dimensional wake. The numerical results demonstrate that the second and third models provide accurate predictions, but the computer time and memory storage can be considerably saved with the second model.
Dissert. Abstr.

N80-27278 California Univ., Los Angeles.
AIRFOILS AT SONIC VELOCITY Ph.D. Thesis
Egbert Sau-Nam Tse 1980 103 p
Avail: Univ. Microfilms Order No. 8016054

A method for calculating flows and corresponding airfoils shapes where the free-stream Mach number is unity is described.

The calculation is done in two parts; both are on hodograph planes. The basic equation is the Tricomi equation and is solved numerically. In one part which corresponds to the front section of the airfoil, the equation is solved in a region where it changes type. The algorithm developed is thus type dependent. The implicit difference scheme formulates uses a rectangular grid in the elliptic region and a characteristic grid in the hyperbolic region. In the other part which corresponds to the rear part of the airfoil, a method of characteristics is used. The boundary curve is prescribed in the hodograph and the shape of the airfoil is determined afterwards. This is useful in airfoil design. The computed result for a thin wedge is in good agreement with analytic results obtained by others. Airfoil with convex surfaces and parabolic noses are generated. Their center of pressure distribution, lift coefficient, drag coefficient and moment coefficient are also obtained. Dissert. Abstr.

N80-27279*# National Aeronautics and Space Administration, Washington, D. C.

TRANSONIC SMALL DISTURBANCES EQUATION APPLIED TO THE SOLUTION OF TWO-DIMENSIONAL NONSTEADY FLOWS

M. Couston, J. J. Angelini, and P. Mulak Apr. 1980 36 p refs Transl. into ENGLISH from la Rech. Aerospatiale, no. 5, Sep. - Oct. 1979 p 325-340 Original document prepared by ONERA Original language document announced as A80-12357 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75795) Avail: NTIS HC A03/MF A01 CSCL 20D

Transonic nonsteady flows are of large practical interest. Aeroelastic instability prediction, control figured vehicle techniques or rotary wings in forward flight are some examples justifying the effort undertaken to improve knowledge of these problems is described. The numerical solution of these problems under the potential flow hypothesis is described. The use of an alternating direction implicit scheme allows the efficient resolution of the two dimensional transonic small perturbations equation L.F.M.

N80-27280*# Boeing Aerospace Co., Seattle, Wash.

AN IMPROVED PANEL METHOD FOR THE SOLUTION OF THREE-DIMENSIONAL LEADING EDGE VORTEX FLOWS. VOLUME 2: USER'S GUIDE AND PROGRAMMER'S DOCUMENT Report, Dec. 1977 - May 1979

E. N. Tinoco, P. Lu, and F. T. Johnson Washington NASA Jul. 1980 176 p refs
(Contracts NAS1-15169; NAS1-15275)
(NASA-CR-3279) Avail: NTIS HC A09/MF A01 CSCL 01A

A computer program developed for solving the subsonic, three dimensional flow over wing-body configurations with leading edge vortex separation is presented. Instructions are given for the proper set up and input of a problem into the computer code. Program input formats and output are described, as well as the overlay structure of the program. The program is written in FORTRAN. A.R.H.

N80-27281*# Lockheed-Georgia Co., Marietta.

EXPLORATORY STUDIES OF THE CRUISE PERFORMANCE OF UPPER SURFACE BLOWN CONFIGURATIONS Final Summary Report

J. A. Braden, J. P. Hancock, J. E. Hackett, K. P. Burdges, and V. Lyman Washington NASA Jul. 1980 191 p refs
(Contract NAS1-13871)
(NASA-CR-3193; LG77ER0028) Avail: NTIS HC A09/MF A01 CSCL 01A

The data and major conclusions obtained from an experimental/analytical study of upper-surface blown (USB) configurations at cruise are summarized. The high-speed (subsonic) experimental work, studying the aerodynamic effects of wing-nacelle geometric variations, was conducted around semi-span model configurations composed of diversified, interchangeable components. Power simulation was provided by high pressure air ducted through closed forebody nacelles. Nozzle geometry was varied across size, exit aspect ratio, exit position and boattail angle. Both 3-D force and 2-D pressure measurements were obtained at cruise Mach numbers from 0.5 to 0.8 and at nozzle pressure ratios up to about 3.0. The experimental investigation was supported by an analytical synthesis of the system using a vortex lattice representation with first-order power effects. Results are also presented from a compatibility study in which a short-haul transport is designed on the basis of the aerodynamic findings in the experimental study as well as acoustical data obtained in a concurrent program. High-lift test data are used to substantiate the projected performance of the selected transport design. A.R.H.

N80-27282*# Boeing Aerospace Co., Seattle, Wash.

AN IMPROVED PANEL METHOD FOR THE SOLUTION OF THREE-DIMENSIONAL LEADING-EDGE VORTEX FLOWS. VOLUME 1: THEORY DOCUMENT Topical Report, Dec. - May 1977

F. T. Johnson, P. Lu, and E. N. Tinoco Washington NASA Jul. 1980 123 p refs
(Contract NAS1-15169; NAS1-15275)
(NASA-CR-3278) Avail: NTIS HC A06/MF A01 CSCL 01A

An improved panel method for the solution of three dimensional flow and wing and wing-body combinations with leading edge vortex separation is presented. The method employs a three dimensional inviscid flow model in which the configuration, the rolled-up vortex sheets, and the wake are represented by quadratic doublet distributions. The strength of the singularity distribution as well as shape and position of the vortex spirals are computed in an iterative fashion starting with an assumed initial sheet geometry. The method calculates forces and moments as well as detail surface pressure distributions. Improvements include the implementation of improved panel numerics for the purpose of elimination the highly nonlinear effects of ring vortices around double panel edges, and the development of a least squares procedure for damping vortex sheet geometry update instabilities. A complete description of the method is included. A variety of cases generated by the computer program implementing the method are presented which verify the mathematical assumptions of the method and which compare computed results with experimental data to verify the underlying physical assumptions made by the method. F.O.S.

N80-27283*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EFFECT OF REYNOLDS NUMBER ON STABILITY CHARACTERISTICS OF A CRUCIFORM WING-BODY

Robert L. Stallings, Jr., Milton Lamb, and Carolyn B. Watson Jul. 1980 111 p refs
(NASA-TP-1683; L-13530) Avail: NTIS HC A06/MF A01 CSCL 01A

An experimental investigation was conducted to determine the effect of Reynolds number on the stability characteristics of a body with cruciform wings at large angles of attack. Pressure distributions and force and moment data (axial force not measured) are presented for Mach 1.60 and 2.70, Reynolds numbers based on body diameter from approximately 130,000 to 2,800,000, and angles of attack from 0 deg to 50 deg. In general, the data show only small effects of Reynolds number throughout the range of test condition. Also discussed are force balance and pressure data that suggest a direct relationship between wind choking and the onset of a nonlinear stability variation with angle of attack. Author

N80-27284*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CAS2D: FORTRAN PROGRAM FOR NONROTATING BLADE-TO-BLADE, STEADY, POTENTIAL TRANSONIC CASCADE FLOWS

Djordje S. Dulikravich Jul. 1980 36 p refs
(NASA-TP-1705; E-253) Avail: NTIS HC A03/MF A01 CSCL 01A

An exact, full-potential-equation (FPE) model for the steady, irrotational, homentropic and homoenergetic flow of a compressible, homocompositional, inviscid fluid through two dimensional planar cascades of airfoils was derived, together with its appropriate boundary conditions. A computer program, CAS2D, was developed that numerically solves an artificially time-dependent form of the actual FPE. The governing equation was discretized by using type-dependent, rotated finite differencing and the finite area technique. The flow field was discretized by providing a boundary-fitted, nonuniform computational mesh. The mesh was generated by using a sequence of conforming mapping.

nonorthogonal coordinate stretching, and local, isoparametric, bilinear mapping functions. The discretized form of the FPE was solved iteratively by using successive line overrelaxation. The possible isentropic shocks were correctly captured by adding explicitly an artificial viscosity in a conservative form. In addition, a three-level consecutive, mesh refinement feature makes CAS2D a reliable and fast algorithm for the analysis of transonic, two dimensional cascade flows. Author

N80-27285*# Transportation Systems Center, Cambridge, Mass.
FAA/NASA PROCEEDINGS WORKSHOP ON WAKE VORTEX ALLEVIATION AND AVOIDANCE
William D. Wood, ed. Oct. 1979 343 p Workshop held at Cambridge, Mass., 28-29 Nov. 1978; sponsored by FAA, Washington, D.C. Sponsored in part by NASA
(NASA-CR-163317; AD-A077897; TSC-FAA-79-77; FAA-RD-79-105) Avail: NTIS HC A15/MF A01 CSCL 01/2

This document is a record of the joint FAA/NASA Workshop on Wake Vortex Alleviation and Avoidance conducted at the DOT Transportation Systems Center, November 28-29, 1978. The workshop was sponsored by the Federal Aviation Administration to apprise the appropriate specialists of the state of the art and to formulate program recommendations for wake vortex alleviation at the source, for wake avoidance systems, and for operations, and safety regulations. GRA

N80-27286*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN ALTERNATIVE APPROACH TO THE NUMERICAL SIMULATION OF STEADY INVISCID FLOW
Gary M. Johnson Jun. 1980 8 p refs Presented at 7th Intern. Conf. on Numerical Methods in Fluid Dyn., Stanford, Calif., 23-27 Jun. 1980; sponsored by NACA, AFOSR, NSF, and ONR
(NASA-TM-81542) Avail: NTIS HC A02/MF A01

A numerical procedure for the efficient simulation of steady inviscid flow is described and its utility demonstrated. Application of the surrogate equation technique allows the formulation of stable, fully conservative, type dependent finite difference equations for use in obtaining numerical solutions to systems of first order partial differential equations, such as the steady state Euler equations or their various approximations. Computational results are presented for the full Euler equations and for the transonic disturbance equations. For the latter case, a computational efficiency greater than that obtained by means of the standard perturbation potential approach is indicated. E.D.K.

N80-27287*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXPERIMENTAL STUDIES OF SCALE EFFECTS ON OSCILLATING AIRFOILS AT TRANSONIC SPEEDS
Sanford S. Davis Jul. 1980 16 p refs
(NASA-TM-81216; A-8259) Avail: NTIS HC A02/MF A01 CSCL 01A

Experimental data are presented on the effect of Reynolds number on unsteady pressures induced by the pitching motion of an oscillating airfoil. Scale effects are discussed with reference to a conventional airfoil (NACA 64A010) and a supercritical airfoil (NLR 7301) at mean-flow conditions that support both weak and strong shock waves. During the experiment the Reynolds number was varied from 3,000,000 to 12,000,000 at a Mach number and incidence necessary to induce the required flow. Both fundamental frequency and complete time history data are presented over the range of reduced frequencies that is important in aeroelastic applications. The experimental data show that viscous effects are important in the case of the supercritical airfoil at all flow conditions and in the case of the conventional airfoil under strong shock-wave conditions. Some frequency-dependent viscous effects were also observed. Author

N80-27288*# Pennsylvania State Univ., University Park.
THREE DIMENSIONAL MEAN FLOW AND TURBULENCE CHARACTERISTICS OF THE NEAR WAKE OF A COMPRESSOR ROTOR BLADE Final Report
A. Ravindranath and B. Lakshminarayana Jun. 1980 298 p refs
(Grant NsG-3012)
(NASA-CR-159518; PSU-TURBO-R-80-4) Avail: NTIS HC A13/MF A01 CSCL 01A

The investigation was carried out using the rotating hot wire technique. Measurements were taken inside the end wall boundary layer to discern the effect of annulus and hub wall boundary layer, secondary flow, and tip leakage on the wake structure. Static pressure gradients across the wake were measured using a static stagnation pressure probe insensitive to flow direction changes. The axial and the tangential velocity defects, the radial component of velocity, and turbulence intensities were found to be very large as compared to the near and far wake regions. The radial velocities in the trailing edge region exhibited characteristics prevalent in a trailing vortex system. Flow near the blade tips found to be highly complex due to interaction of the end wall boundary layers, secondary flows, and tip leakage flow with the wake. The streamwise curvature was found to be appreciable near the blade trailing edge. Flow properties in the trailing edge region are quite different compared to that in the near and far wake regions with respect to their decay characteristics, similarity, etc. Fourier decomposition of the rotor wake revealed that for a normalized wake only the first three coefficients are dominant. E.D.K.

N80-27289# Detroit Diesel Allison, Indianapolis, Ind.
TIME-VARIANT AERODYNAMICS FOR TORSIONAL MOTION OF LARGE-TURNING AIRFOILS Final Report
R. L. Jay, M. D. Rothrock, R. E. Riffel, and G. T. Sinnat Jan. 1980 109 p refs
(Contract N00019-79-C-0087)
(AD-A083766; DDA-EDR-10192) Avail: NTIS HC A06/MF A01 CSCL 20/4

A cascade of five airfoil sections modelling the hub section of an advanced design turbine featuring a high inlet Mach number and 112 degrees of turning was evaluated at 4 steady-state conditions of varying exit Mach number and expansion ratio. The resulting steady-state airfoil surface pressures were compared to a state-of-the-art analytical prediction. A time-variant investigation was conducted at the 4 operating conditions of the steady-state experiment. Time-variant pressure signals were obtained from a Kulite-instrumented airfoil as the cascade was torsionally oscillated at four values of interblade phase angle per expansion ratio by computer-controlled electromagnetic drive systems. The dynamic pressure signals were evaluated in amplitude and phase lag (referenced to blade motion) and correlated with a state-of-the-art analytical prediction based on a flat-plate cascade. A quasi-static experiment was performed to relate the dynamic surface pressure amplitudes to those obtained by resetting the cascade to various temporal positions in the torsional cycle of oscillation. GRA

N80-27290# Nielsen Engineering and Research, Inc., Mountain View, Calif.
DATA REPORT FOR AN EXTENSIVE STORE SEPARATION TEST PROGRAM CONDUCTED AT SUPERSONIC SPEEDS Final Report, Jun. 1975 - Aug. 1979
Frederick K. Goodwin and Calvin L. Dyer (AFFDL) Wright-Patterson AFB, Ohio AFFDL Dec. 1979 292 p refs
(Contract F33615-76-C-3077; AF Proj. 2403)
(AD-A083848; NEAR-TR-205; AFFDL-TR-79-3130) Avail: NTIS HC A13/MF A01 CSCL 20/4

This report describes an extensive store separation test program conducted at Mach number range covering 1.5 to 2.5. The purpose of the program was to provide a systematic set of data which could be used to evaluate and improve analytical techniques for predicting supersonic store separation trajectories. Parent aircraft configurations tested ranged from a simple circular body, mid-wing configuration without pylons and racks to a noncircular fuselage with wing, flow through engine inlets, and pylons and racks. The parent configuration was built up component by component so model component effects could be isolated. Flow-field survey, store pressure-distribution, store force-and-moment and store trajectory data were obtained. The store tested were circular and elliptical in cross section with various fin arrangements. The data obtained during five wind-tunnel entries are summarized in this report. The data have been collected on magnetic tapes and FORTRAN computer programs have been written which retrieve the data from the tapes. This report also describes the use of these programs and tapes and describes the tabulated output from the programs. GRA

N80-27291# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.

FLUTTER ANALYSIS OF A TWO-DIMENSIONAL AND TWO-DEGREE-OF-FREEDOM SUPERCRITICAL AIRFOIL IN SMALL-DISTURBANCE UNSTEADY TRANSONIC FLOW Final Report, Nov. 1978 - Oct. 1979

T. Y. Yang, P. Guruswamy, and Alfred G. Striz Wright-Patterson AFB, Ohio AFWAL Mar. 1980 94 p refs

(Grant AF-AFOSR-3523-78; AF Proj. 2307)

(AD-A084172; AFWAL-TR-80-3010) Avail: NTIS HC A05/MF A01 CSCL 20/4

Flutter analysis is performed for a MBB A-3 supercritical airfoil at transonic Mach numbers. Two degrees of freedom, pitching and plunging, are considered. The unsteady aerodynamic data are obtained by using two separate transonic aerodynamic computational codes: (1) LTRAN2 based on the time integration method and (2) STRANS2 and UTRANS2 based on the harmonic analysis method. The steady aerodynamic results are shown in the form of upper and lower surface pressure curves. The unsteady aerodynamic coefficients are obtained and tabulated for various values of low reduced frequency by pitching the MBB A-3 airfoil about the quarter chord axis. For the case of zero mean angle of attack, the coefficients obtained by the two computer codes are directly compared and discussed. At design Mach number of 0.765 and zero mean angle of attack, flutter results are obtained by both methods and compared. They are presented as plots of flutter speed and the corresponding reduced frequency vs. one of the four parameters: airfoil - air mass ratio; position of mass center; position of elastic axis; and plunge-to-pitch frequency ratio. GRA

N80-27292# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.

THE LOW-SPEED CHARACTERISTICS OF A 15-PERCENT QUASI-ELLIPTICAL CIRCULATION CONTROL AIRFOIL WITH DISTRIBUTED CAMBER Final Report

Jane Abramson May 1979 46 p refs

(AD-A084176; DTNSRDC/ASED-79/07) Avail: NTIS HC A03/MF A01

The aerodynamic characteristics of a circulation control elliptic airfoil section with a 15-percent thickness-to-chord ratio were evaluated subsonically. The airfoil, designated NCCR1513-7559E, incorporates a high degree of nose camber and an increased leading edge radius in a profile designed for high subsonic speeds. Critical Mach numbers in excess of 0.7 were predicted analytically for several typical operating conditions. Lift coefficients up to 4.63 were produced at momentum coefficients of 0.22. Equivalent lift-to-drag ratios of approximately 40 were also produced at C(l)= 0.8. GRA

N80-27293# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.

NUMERICAL OPTIMIZATION OF CIRCULATION CONTROL AIRFOILS Interim Report, Sep. 1978 - Dec. 1979

Tsze C. Tai, George H. Kidwell, Jr., and Garret N. Vanderplaats Apr. 1980 51 p refs

(ZR0230201)

(AD-A084129; DTNSRDC/AERO-1265; DTNSRDC-80/060) Avail: NTIS HC A04/MF A01 CSCL 20/4

A numerical procedure developed for optimizing the circulation control airfoils is presented. The procedure finds the optimum basis airfoil shapes subjected to specified flow conditions and geometric constraints. It consists of a numerical optimization code for linear constrained problems coupled with a viscous-potential flow interaction analysis for necessary viscous-inviscid flow field calculations. The desired airfoil shape is defined by a combination of baseline shapes representative of airfoils suitable for circulation control purposes. The coefficients of these basis vectors are then used as the design variables in the optimization process. Three baseline shapes (a cambered ellipse, a cambered ellipse with a drooped trailing edge, and a cambered ellipse with a logarithmically spiralled trailing edge) are employed for special contouring of the trailing edge geometry. With some minor modification of the analysis method, the combined program allows optimization for maximum lift without substantial difficulty; but for minimizing the drag, further improvement of the analysis method is required. GRA

N80-27294# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.

A SECOND ORDER ACCURATE NUMERICAL METHOD FOR SUPERSONIC BOUNDARY LAYER FLOW PAST A COMPRESSION CORNER M.S. Thesis. Final Report, May 1976 - May 1979

Bernardo Fortunato and M. J. Werle Jun. 1979 91 p refs (Contract F33615-76-C-3091; AF Proj. 2307)

(AD-A084550; AFFDL-TR-79-3061) Avail: NTIS CSCL 20/4

The compressible and incompressible boundary layer equations are solved for laminar flow past a configuration with an interior (concave) compression region. The approach first employs conformal coordinates to map the body geometry to a flat wall, and then the boundary layer scale laws to identify the principal terms of the compressible counterpart of the Navier-Stokes equations. A Levy-Lees type transformation is identified in these coordinates to simplify the governing equations. These are then solved with a second order accurate numerical scheme in both the longitudinal and normal directions. Solutions are obtained for adiabatic and 'warm' wall conditions for configurations with and without separation. Emphasis is placed here on achieving accurate reliable results while maintaining minimal computer time expenditure. GRA

N80-27295# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mathematics.

FINITE ELEMENT ANALYSIS OF TRANSONIC FLOWS Final Report, 1 Nov. 1976 - 31 Oct. 1979

George J. Fix May 1980 8 p refs

(Grant DAAG29-77-G-0026)

(AD-A084636; ARO-14371.9-M) Avail: NTIS HC A02/MF A01 CSCL 20/4

Finite element algorithms were developed for the following class of problems: (1) Transonic flow problems governed by the potential equations; (2) Moving boundary problems; and (3) Incompressible flow problems governed by the Navier-Stokes equations. GRA

N80-27296# ARO, Inc., Arnold Air Force Station, Tenn.

MUTUAL INTERFERENCE OF MULTIPLE BODIES IN THE FLOW FIELD OF THE F-4C AIRCRAFT IN THE TRANSONIC SPEED RANGE Final Report, 12 - 21 Nov. 1979

A. A. Hesketh AEDC Dec. 1979 90 p refs

(AD-A084704; AEDC-TSR-79-P79) Avail: NTIS HC A05/MF A01 CSCL 20/4

A wind tunnel field was conducted to study the mutual interference of multiple bodies in the flow field of the F-4C aircraft. The test utilized 1/20 scale models of the F-4C aircraft, the MK-83 bomb (with and without fins) and the triple ejector rack (TER) to obtain aerodynamic loads on the MK-83 at, and near, the carriage position on the wing inboard pylon. Flow field data in the vicinity of the TER were also obtained. Test variables included aircraft angle of attack from -3 to 17 deg, freestream Mach number from 0.60 to 0.95, and aircraft configuration. Freestream aerodynamic loads data were also obtained on the MK-83 bomb model. GRA

N80-27297# Air Force Geophysics Lab., Hanscom AFB, Mass. Aerospace Instrumentation Div.

GAS REPLENISHMENT TECHNIQUES FOR USE IN HIGH-ALTITUDE, LONG-DURATION SCIENTIFIC BALLOON FLIGHTS Final Report

Andrew S. Carten, Jr. and Charles F. Sindt 14 Nov. 1979 78 p refs

(AD-A084486; AFGL-TR-79-0278; AFGL-IP-283) Avail: NTIS HC A05/MF A01 CSCL 20/4

This report covers the theoretical advantages and practical ramifications of a proposed new technique for compensating for the daily loss of lift (gamma) experienced by long-duration high-altitude scientific balloon flights. This technique, 'Gas Replenishment' would transfer stored helium from an onboard dewar to the balloon, to replace gas lost due to temperature excursions. It would be a direct substitute for systems presently in use which drop ballast, that is, reduce system gross weight, to compensate for loss of lift. With gas replenishment, lift is restored directly, with only a small change in system gross weight. A short summary of zero pressure balloon flight theory is given at the start, to lead into the explanation of conventional ballast

practices and computations. The ballast equations are then modified to apply to the gas replenishment technique. Calculations for typical constant-gamma flights are summarized for each method of loss compensation and the clear superiority of gas replenishment is demonstrated in the areas of gross system weight of launch, usable payload weight and anticipated flight duration. Basic equations are then developed for a more complicated model of the gas replenishment system in which the value of gamma varies from day to day. Computations using these formulas are summarized in tabular form. The final section of the report is given over to the design problems associated with the type of dewar and heat exchange equipment needed to implement the gas replenishment concept. GRA

N80-27298# National Technical Information Service, Springfield, Va.
LIGHTER THAN AIR VEHICLES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1980
Guy E. Habercom, Jr. Apr. 1980 272 p Supersedes NTIS/PS-79/0471 and NTIS/PS-78/0409
(PB80-808066; NTIS/PS-79/0471; NTIS/PS-78/0409) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 01C

The design and applications of balloons, dirigibles, and airships are investigated in these Government-sponsored research reports. Passenger or cargo transport, tethering, and fabric selection are among the aspects investigated. Meteorological balloons are excluded. This updated bibliography contains 265 abstracts, 15 of which are new entries to the previous edition. GRA

N80-27299# National Technical Information Service, Springfield, Va.
LIGHTER THAN AIR VEHICLES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1980
Guy E. Habercom, Jr. Apr. 1980 94 p Supersedes NTIS/PS-79/0472 and NTIS/PS-78/0410
(PB80-808074; NTIS/PS-79/0472; NTIS/PS-78/0410) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 01/C

Safety factors related to the use of balloons, dirigibles and serostats for passenger and cargo transport are considered in reports from worldwide literature. Structural design, material selection and tethering are discussed as well as the use of airships for heavy lift operations. This updated bibliography contains 89 abstracts, 7 of which are new to the previous edition. A.R.H.

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-27300 Ohio State Univ., Columbus.
GENERAL AVIATION DYNAMICS: THE IMPACT OF COST RECOVERY Ph.D. Thesis
Michael Alan Duff 1980 231 p
Avail: Univ. Microfilms Order No. 8015869

The regulation of air commerce to promote its development and safety as well as the operation of the air traffic control system are discussed. A complete application of the policy approach to the problem of general aviation cost recovery is described. Some additional quantitative insight into understanding the general aviation system and its probable response to increased user charges are provided. Dissert. Abstr.

N80-27301 California Univ., Los Angeles.
A DYNAMIC MODEL OF THE AIR TRANSPORT INDUSTRY Ph.D. Thesis
Mohammad Bagher Ayati 1980 298 p
Avail: Univ. Microfilms Order No. 8015950

A modeling process to stimulate the dynamic process of economics of the Air Transportation industry is presented. The model process consists of development of a conceptual model to relate aircraft technology, aviation fuels, airline operation, and economics of air transportation. A methodology based on digraph theory is suggested to facilitate a straightforward technique for presentation and simulation of a class of socio-economic systems. The methodology has been successfully applied to simulate a dynamic model of air transportation economics. Results of the model validation shows negligible difference between actual and projected values. Dissert. Abstr.

N80-27302*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
TIRE STIFFNESS AND DAMPING DETERMINED FROM STATIC AND FREE-VIBRATION TESTS
Robert K. Sleeper and Robert C. Dreher Jul. 1980 45 p refs (NASA-TP-1671; L-13500) Avail: NTIS HC A03/MF A01 CSCL 01C

Stiffness and damping of a nonrolling tire were determined experimentally from both static force-displacement relations and the free-vibration behavior of a cable-suspended platen pressed against the tire periphery. Lateral and force-and-aft spring constants and damping factors of a 49 x 17 size aircraft tire for different tire pressure and vertical loads were measured assuming a rate-independent damping form. In addition, a technique was applied for estimating the magnitude of the tire mass which participates in the vibratory motion of the dynamic tests. Results show that both the lateral and force-and-aft spring constants generally increase with tire pressure but only the latter increased significantly with vertical tire loading. The fore-and-aft spring constants were greater than those in the lateral direction. The static-spring-constant variations were similar to the dynamic variations but exhibited lower magnitudes. Damping was small and insensitive to tire loading. Furthermore, static damping accounted for a significant portion of that found dynamically. Effective tire masses were also small. Author

N80-27303*# National Aeronautics and Space Administration, Washington, D. C.
THE DEVELOPMENT OF THE ZEPPLIN DIRIGIBLE FOR LONG DISTANCE TRANSPORTATION
Albert Ehrle Apr. 1980 18 p Transl. into ENGLISH of "Gedenken an die Hundertste Wiederkehr des Geburtstages des Grafen Zeppelin", Deutchen Academie der Luftfahrtforschung, West Germany, 17 Jun. 1938 p 33-47 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76143) Avail: NTIS HC A02/MF A01 CSCL 01C

Changes in the design and construction of German airships for regular transoceanic passenger transportation during the 1916 to 1938 period are described. Technical problems related to structural weight, fuel reduction, and passenger comfort are considered. A.R.H.

N80-27304# Federal Aviation Administration, Washington, D. C. Office of Aviation Medicine.
THE 1976 ACCIDENT EXPERIENCE OF CIVILIAN PILOTS WITH STATIC PHYSICAL DEFECTS
J. Robert Dille and Charles F. Booze Aug. 1979 8 p refs (AD-A077189; FAA-AM-79-19) Avail: NTIS HC A02/MF A01 CSCL 01/2

The 1974 and 1975 aircraft accident experiences of civilian pilots with eight selected static physical defects have been examined and reported previously. Three categories, blindness or absence of either eye, deficient color vision with a waiver, and deficient distant vision, had significantly more accidents than were expected on the basis of observed-to-expected ratios. However, pilots with these conditions reported considerably higher median 6-month flight times than did an active airman population sample and accident airmen without selected pathology. In 1975 the reported recent and total flying times for all airmen with these defects were determined and accident rates were calculated. The rates for airmen with blindness or absence of an eye were still found to be significantly higher. The contact lens group was also selected to receive special attention in a study of the 1976 accident data because marginal significance was found on analysis of the 1975 data and, after 1976, this group will not carry a pathology code or require a waiver and thus will be difficult to study. Observed-to-expected ratios for

1976 are 1.91 for deficient color vision with a waiver, 1.28 for contact lens users, 1.37 for blindness or absence of either eye, and 1.62 for deficient distant vision. The accident rates per 100,000 hours of cumulative and last 6 months' flying experience were significantly greater for contact lens users and monocular pilots than for the active airman population. GRA

N80-27306# Federal Aviation Administration, Washington, D. C. Office of Management Systems.
CURRENT AVIATION STATISTICS: AIR TRAFFIC ACTIVITY TERMINAL AREA RELATIONSHIPS, FISCAL YEARS 1977 AND 1978
1979 101 p
(AD-A078617; FAA-AMS-220-79-4) Avail: NTIS HC A06/MF A01 CSCL 01/2

Busy hour estimates are obtained from periodic counts of 60 minutes in duration. These counts are made during known high activity periods for each traffic category. From this sample, tower personnel select a count which is representative of daily busy hour activity for each category. The statistical tables in this publication contain traffic estimates for each airport at which an air traffic control tower operated during all of FY 1977 and FY 1978. Provided with peak day and busy hour counts are average day and hour operations computed from the annual operations counts. Measures of peaking characteristics are given by the ratios peak day to average day and busy hour to average hour by individual airport by size group. GRA

N80-27308# Transportation Systems Center, Cambridge, Mass.
CHICAGO MONOSTATIC ACOUSTIC VORTEX SENSING SYSTEM. VOLUME 1: DATA COLLECTION AND REDUCTION Final Report, Jan. 1976 - Sep. 1977
D. C. Burnham Oct. 1979 34 p refs
(AD-A076929; TSC-FAA-79-18-1-Vol-1; FAA-RD-79-103-1) Avail: NTIS HC A03/MF A01 CSCL 20/4

A Monostatic Acoustic Vortex Sensing System MAVSS was installed at Chicago's O'Hare International Airport to measure the strength and decay of aircraft wake vortices from landing aircraft. The MAVSS consists of an array of acoustic antennas which measure the vertical profile up to 60 m altitude of the vertical component of the wind. The decay in wake vortex strength is measured as the vortex passes over successive antennas in the array. Volume I describes the MAVSS principles of operation, the hardware developed, and data reduction methods employed. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-27307# Systems Control, Inc., Palo Alto, Calif.
WEST COAST LORAN-C FLIGHT TEST Final Report
Thomas E. Scalise, Erich Bolz, and Edwin D. McConkey Mar. 1980 209 p refs
(Contract DOT-FA75WA-3662)
(AD-A084039; FAA-RD-80-28) Avail: NTIS HC A10/MF A01 CSCL 17/7

A flight test program was flown within the coverage area of the West Coast Loran-C chain during June and July 1979. The purpose of the test was to add to the growing statistical data base that will be used to assess Loran-C as a supplement to, or replacement for, the present VOR/DME navigation system. The test objectives were to: (1) Evaluate the West Coast Loran-C chain by quantifying navigation and position errors within its coverage area; (2) Test Loran-C as a non-precision approach aid in mountainous conditions, using a commercially available Loran-C receiver/navigator, in this case a Teledyne TDL-711; (3) Record the effects of bias shifts and station outages on overall accuracy and approach procedures, especially near a baseline extension; (4) Calculate the absolute flight technical error (FTE) during Loran-C approaches using a typical general aviation aircraft. The main conclusions of the test were: The West Coast Loran-C chain appears stable and dependable. Time difference errors were consistent and related to signal propagation differences over land and over water; TDL-711 was found to be easy to operate, giving stable and repeatable course guidance, although susceptible to random loss of track, a problem which may be software related. The system did not accurately calculate cross track deviation and distance to waypoint. Without needed hardware, software, and/or procedural changes, Loran-C may not meet the RNAV non-precision approach requirements of AC 90-45A. GRA

N80-27308# National Aviation Facilities Experimental Center, Atlantic City, N. J.
ATARS/ATC SIMULATION TESTS WITH SITE ADAPTATION LOGIC IN THE PHILADELPHIA TERMINAL AREA Final Report, May - Oct. 1978
Gary W. Morfitt, Sidney B. Rossiter, James R. Windle, Arthur W. Fillius, and Thomas A. Choyce Mar. 1980 56 p refs
(FAA Proj. 034-242-340)
(AD-A083718; FAA-NA-79-23; FAA-RD-79-116) Avail: NTIS HC A04/MF A01 CSCL 17/7

The purpose of this project was to provide further evaluation and refinement of the Automatic Traffic Advisory and Resolution Service (ATARS) concept. The tests were conducted at the National Aviation Facilities Experimental Center (NAFEC) at Atlantic City, New Jersey, using the Air Traffic Control Simulation Facility (ATCSF). Test results indicated that ATARS had no significant impact on the controllers or control procedures in a Philadelphia Terminal Control Area (TCA) environment. Outside the immediate TCA, where the majority of encounters occurred, the factors contributing to the generation of alarms were, in general, satellite operations and the use of Visual Flight Rules (VFR) separation criteria. The incidence of positive resolution advisories was low, averaging only 0.5 encounters per hour. Recommendations are to reduce the size of the ATARS desensitization zone at the Philadelphia main airport to approximately 2.0 nautical miles (nmi) from runway thresholds, to incorporate a convergence/divergence detection filter into the ATARS algorithm, and to investigate the possibility of reducing tracker lag by improving turn and level off detection. GRA

N80-27309# AMAF Industries, Columbia, Md.
FEASIBILITY OF OFFSET CARRIER SYSTEMS FOR AIR TRAFFIC CONTROL Interim Report
J. David Claiborne Oct. 1979 17 p refs
(Contract DOT-FA78WAI-830)
(AD-A084044; FAA-RD-79-106; IR-2) Avail: NTIS HC A02/MF A01 CSCL 17/7

A brief description of FAA trials of offset carriers systems and multiple outlet systems is given. Short descriptions are also given of existing offset carrier systems in Great Britain and the ARINC system in the United States. The communication deficiencies that could be remedied by an offset carrier system are listed. A short discussion is given concerning the system design deficiencies inherent with an offset carrier system. No conclusions are made concerning the usefulness or practicality of an offset carrier system. GRA

N80-27310# Arinc Research Corp., Annapolis, Md.
AN EVALUATION OF AIRCRAFT SEPARATION ASSURANCE CONCEPTS USING AIRLINE FLIGHT SIMULATORS. VOLUME 1: STUDY REPORT Final Report
Bruce Morgenstern and Thomas P. Berry Nov. 1979 108 p
(Contract DOT-FA78WA-4091)
(AD-A083986; Rept-1343-01-3-2058-Vol-1; FAA-RD-79-124-1) Avail: NTIS HC A06/MF A01 CSCL 01/2

This report documents an evaluation of Aircraft Separation Assurance (ASA) concepts using an airline flight simulator. The primary objective of the experiment was to determine the cockpit information requirements for an aircraft collision avoidance system. Qualified pilots from commercial aviation and industry flew typical operational scenarios in the simulated Los Angeles area. During the flight, conflict situations with other aircraft developed, and pilots were asked to respond to these situations on the basis of

information presented to them by one of three experimental collision avoidance displays. Computer-collected data on pilot response to collision avoidance commands and resultant miss distances were correlated with data from questionnaires filled out by participating pilots to determine the cockpit information requirements. The subjective commments addressed the areas of required display information items, use of color, audible alert, symbols, workload, pilot confidence in the system, and pilot display preference. Altitude, range, relative bearing, and other aircraft heading have been identified as the most important and most essential information elements in the resolution of potential conflicts. The report provides a statistical analysis of the accumulated data and includes recommendations for the development and operational implementation of the ASA program. GRA

N80-27311# Arinc Research Corp., Annapolis, Md.
AN EVALUATION OF AIRCRAFT SEPARATION ASSURANCE CONCEPTS USING AIRLINE FLIGHT SIMULATORS. VOLUME 2: APPENDICES Final Report
Bruce Morgenstern and Thomas P. Berry Nov. 1979 170 p refs
(Contract DOT-FA78WA-4091)
(AD-A083897; Rept-1343-01-3-2058-Vol-2; FAA-RD-79-124-2) Avail: NTIS HC A08/MF A01 CSCL 01/2

This report supplements the main study report of a cockpit evaluation of ASA concepts. It contains a description of the flight scenarios used, a copy of the pilot advance briefing and pre-briefing copies of the flight crew questionnaire and supplemental questionnaire with all comments, data analysis formulas, and test bed description details. GRA

N80-27312# Ohio Univ., Athens. Avionics Engineering Center.
IN-SERVICE IMPROVEMENTS TO RELIABILITY AND MAINTAINABILITY OF THE INSTRUMENT LANDING SYSTEM Final Report, Oct. 1977 - May 1979
May 1979 487 p refs
(Contract DOT-FA78WA-4062)
(AD-A075556; EER-40-1; FAA-R-6750.2; FAA-AAF-420) Avail: NTIS HC A21/MF A01 CSCL 17/7

This report documents results of task efforts undertaken by Ohio University between October 1977 and May 1979. Engineering data resulting from a study of the sideband reference, glide-slope system baseline operating parameters and the effects of specific faults are presented. A series of perturbational studies conducted at commissioned sideband reference facilities and numerous field experiments at Ohio University's Tamiami, Florida site facility are described. Suggested technical improvements and text changes for existing technical manuals have also resulted. The effects of a wide range of terrain profiles on the performance of sideband reference, null reference, and capture effect systems are compiled in album form. Sideband reference system setup procedures are reviewed, the electrical and physical requirements for the counterpoise are explored, and an introductory look at threshold-plane DDM profiles is presented. ILS anomaly investigations have resulted in the design, testing, and implementation of a modification to the Type FA-5723 clearance transmitter. Also, predictions of complete glide-slope performance for a proposed site on Runway 22L at Boston Logan are presented. The maximum allowable VSWR for the 15-element V-Ring and the O-Ring localizers are investigated based on theoretical and experimental work. The findings are that the maximum VSWR is not that of a simple specification but rather that of values that are within the bounds of worst and best-case conditions depending on the value of the complex reflection coefficient. GRA

N80-27313# National Telecommunication Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
POTENTIAL USE OF HIGH FREQUENCY DATA TRANSMISSION FOR OCEANIC AIR TRAFFIC CONTROL IMPROVEMENT Final Report, Aug. 1978 - Jul. 1979
Martin Nesenbergs Sep. 1979 48 p refs
(Contract DOT-FA-RA-78-15)
(AD-A075810; FAA-AM-TSC-79-9) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report is concerned with the transatlantic Air Traffic Control (ATC) data links in the high frequency (HF) band. The report tries to broaden the appropriate communication system concepts by fortifying them with general parametric objectives. While such a broad approach cannot escape practical constraints and reductions, especially in eventual design and implementation stages, it is nevertheless a useful tool here. It leads one to characterize the HF propagation medium more fully. This in turn enables one to conceive data communications outlines with more advanced structures and with emphasis on exploiting the latest technology, both hardware and software. A full study should be beyond this initial effort and incorporate several system alternatives, plus their tradeoffs in terms of objective gains versus system costs. This brief report concludes with a parametric summary of ATC HF channel issues, operational factors, and the importance of performance specification. Pertinent unresolved issues are also listed at the end. GRA

N80-27314# Transportation Systems Center, Cambridge, Mass.
ANALYSIS OF EXPANDABILITY AND MODIFIABILITY OF COMPUTER CONFIGURATION CONCEPTS FOR ATC. VOLUME 1: DISTRIBUTED CONCEPT Final Report
David F. Clapp, Joseph B. Hagopian, and Ronald M. Rutledge Nov. 1979 195 p refs
(AD-A084045; TSC-FAA-79-31; FAA-EM-79-22-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 17/7

The questions of expandability and modifiability of a 1990-era Air Traffic Control (ATC) system are addressed. Two strawman systems are described at the functional level: a Baseline System, which represents the ATC system as it might be just after the replacement of the current National Airspace System (NAS) en route computers, and a Future System, which represents what might be derived ten years later under an appropriate scenario for ATC development. A distributed processing computer configuration is postulated for the Baseline System, and processing and communications loads are calculated on the basis of traffic and parameter estimates for 1985. Expansion and modification of the Baseline System to produce the Future System designed to meet estimated 1995 loads under the supplied scenario are examined. The distributed processing concept, as considered here, was deemed generally suitable for use in the ATC system of the future. GRA

N80-27315# Transportation Systems Center, Cambridge, Mass.
AN INVESTIGATION OF LASER LIGHTING SYSTEMS TO ASSIST AIRCRAFT LANDING Final Report, Oct. 1978 - Sep. 1978
D. C. Burnham and J. F. Fantasia Oct. 1979 64 p refs
(AD-A077722; TSC-FAA-79-22; FAA-RD-79-97) Avail: NTIS HC A04/MF A01 CSCL 17/7

A model for the visual detectability of narrow light beams was developed and used to evaluate the system performance of two laser lighting system configurations: (1) a laser VASI and (2) a crossed beam glide path indicator. Laboratory experiments confirmed the validity of the model. Using a criterion taken from the Federal Standard for laser safety, the potential hazards of each of the system concepts were evaluated. The following results were obtained for readily available laser power levels: neither system will work during bright daylight, the laser VASI can be seen at night at the middle marker for visual ranges greater than 5000 ft, the crossed beam system can be seen at night at the middle marker for visual ranges greater than 700 ft. GRA

N80-27316# Transportation Systems Center, Cambridge, Mass.
TESTS OF AN ATCRBS BASED TRILATERATION SENSOR AT LOGAN INTERNATIONAL AIRPORT Final Report, Oct. 1977 - Sep. 1978
P. E. Manning Nov. 1979 65 p
(AD-A078979; TSC-FAA-79-12; FAA-RD-79-115) Avail: NTIS HC A04/MF A01 CSCL 17/7

Field test results of accuracy and coverage for an ATCRBS based surface trilateration sensor at Logan International Airport are described. This sensor was previously tested at NAFEC for feasibility and because of a lack of sufficient aircraft traffic and multipath, further tests were recommended at an operational airport. These tests show that a beacon trilateration sensor can accurately determine the position of a transponder equipped vehicle on the surface, extract its beacon code and provide

excellent coverage without interference with the operational ATCRBS. GRA

N80-27317# Royal Signals and Radar Establishment, Malvern (England).
PRECISION NAVIGATION FOR AIR TRAFFIC MANAGEMENT
S. Radcliffe Oct. 1979 9 p refs Presented at the AGARD GCP Symp., Copenhagen, 29 Oct. 1979
(AD-A083947; RSRE-Memo-3220; DRIC-BR72506) Avail: NTIS HC A02/MF A01 CSCL 17/7

This report discusses the problems that would arise if airspace users had the use of NAVSTAR or some other much better position fixing aid than at present, and the uses that ATC could, or could not, make of this capability. There would be formidable transitional problems in the vertical plane, because NAVSTAR measures height from the Earth's center whereas current altimeters measure atmosphere pressure. In either vertical or horizontal planes much work will be necessary to prove that the separation standards can be reduced at all. The paper discusses changes that might be possible in the ATC system should appreciable reductions in separation standards prove possible. NAVSTAR might form the basis of a collision avoidance system based on either the broadcast coordinates of each aircraft or on a time-frequency basis using NAVSTAR as the time reference. The latter scheme would offer protection of a fully equipped aircraft against a threat that could not afford the expense of a NAVSTAR fit. This paper is a contribution to the 29th AGARD GCP Symposium, Copenhagen, Oct 1979. It is issued as a memo to make it available earlier and in an unclassified document. GRA

N80-27318# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Common Avionics Div.
CHARACTERISTIC FOR A MODERATE ACCURACY INERTIAL NAVIGATION SYSTEM (INS)
24 Aug. 1979 360 p Supersedes ASD/ENAC-77-1-Rev-1-Amend-1-3
(AD-A084036; ASD/ENAC-77-1-Rev-2-Amend-1-3; ASD/ENAC-77-1-Rev-1-Amend-1-3) Avail: NTIS HC A16/MF A01 CSCL 17/7

This specification establishes the requirements in terms of form, fit and function (including performance) for an inertial navigation system applicable to a broad spectrum of vehicles. It is the intent of this specification to define the INS requirements to a sufficient extent to allow multiple contractor designed and produced hardware to be used interchangeably at the LRU level in any given vehicle. GRA

N80-27319# Transportation Systems Center, Cambridge, Mass.
ENHANCED TERMINAL INFORMATION SERVICES (ETIS) UTILIZING THE DISCRETE ADDRESS BEACON SYSTEM (DABS) DATA LINK-CONCEPT DESCRIPTION Final Report, Sep. 1978 - Apr. 1979
Robert W. Wiseleder Jul. 1979 90 p refs
(AD-A073205; TSC-FAA-79-11; FAA-RD-79-73) Avail: NTIS HC A05/MF A01 CSCL 17/7

This report describes a concept for providing enhanced terminal information services (ETIS) to aircraft utilizing the ground-air-ground data link capability of the Discrete Address Beacon System (DABS). ETIS is envisioned as an eventual replacement for, and significant improvement to the Automated Terminal Information Services (ATIS) in use today. The initial step in developing the concept is the establishment of requirements for an ETIS system. This is followed by a determination of the information and data to be provided to the aircraft over the data link, and the probable sources of that data. An assumption is made that the availability of automated weather sensor systems of some form will coincide with implementation of ETIS. A detailed functional description of the system is then given, including system configuration, interfaces with other ATC automation systems, and hardware and software both at the airport and at the controlling ATC facility. Also discussed are message content and formats, controller and pilot display design considerations, criteria for dispatch of ETIS messages, and a number of operational considerations. The report concludes with several typical flight scenarios representative of different levels of aircraft, avionics, and pilot capabilities in an air traffic control environment where ETIS is implemented. GRA

N80-27320# Facility Checking Squadron (1868th) (AFCS), Scott AFB, Ill.
SSILS INITIAL EVALUATION REPORT, DAVIS-MONTHAN AFB, ARIZONA, 16-20 NOVEMBER 1979 Final Report
Joseph P. Coyle 11 Apr. 1980 109 p
(AD-A084635; Rept-79/66N-195) Avail: NTIS HC A06/MF A01 CSCL 01/4

This report presents the results of the 16 - 20 November 1979 TRACALS Evaluation of the Davis-Monthan AFB AN/GRN-29(V), SSILS and associated power systems. The evaluation was conducted in conjunction with the system commissioning to determine the capabilities and limitations of the system in its installed environment. Results presented in this report can be used as a guide to anticipated performance until there is a significant change in ground equipment, siting environment, screening, or operational use. GRA

N80-27321# General Electric Co., Santa Barbara, Calif.
LORAN-C SIGNAL ANALYSIS Final Report, Aug. 1977 - Dec. 1979
Larry W. Nelson and Burt Gambrill Dec. 1979 105 p refs (Contract DOT-CG-64810-A)
(AD-A084239; GE79TMP-78; USCG-D-4-80) Avail: NTIS HC A06/MF A01 CSCL 17/7

This report summarizes the results of experimental efforts and theoretical analysis conducted on the Loran-C Signal Analysis project. Experiments to test the stability of the U.S. West Coast Chain, to provide a data base for assessing the predictability of Loran-C signal phase, and to provide data for calibrating San Francisco Harbor are described. Estimates of system error budgets and evaluation of the performance of Loran-C in various operational modes are also described. GRA

N80-27322# National Technical Information Service, Springfield, Va.
DISCRETE ADDRESS BEACON SYSTEM. CITATIONS FROM THE NTIS DATA BASE
William E. Reed Apr. 1980 161 p Supersedes NTIS/PS-79/0244; NTIS/PS-78/0064
(PB80-807522; NTIS/PS-79/0244; NTIS/PS-78/0064) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 17G

The development of the Discrete Address Beacon System is treated in these Federally-sponsored research reports. Topics include the data link, message formats, antenna systems, signal propagation, transponders, and interface with the Air Traffic Control Radar Beacon System. This updated bibliography contains 154 abstracts, 14 of which are new entries to the previous edition. GRA

N80-27323# National Bureau of Standards, Washington, D.C. Center for Applied Mathematics.
PROBABILITIES OF VERTICAL OVERLAP: A SENSITIVITY ANALYSIS
Howard K. Hung, Judith F. Gilsinn, and Karla F. Hoffman Mar. 1980 72 p refs Sponsored in part by FAA, Washington, DC.
(PB80-161151; NBSIR-80-1990) Avail: NTIS HC A04/MF A01 CSCL 01C

Because of the potential increase in traffic at FL 290 and above, both current and alternative vertical separation standards are being reviewed. A sensitivity analysis carried out to assess how different assumptions about the probability distribution of 'total vertical error' affect the probability of vertical overlap is documented. The four factors affecting the probability of vertical overlap which are examined are: the functional form of the vertical-error distribution function; the standard deviation of this probability distribution; the vertical dimensions of the aircraft; and the vertical separation standard. Probabilities of vertical over-lap were computed over a range of possibilities for each of these four factors in order to discern the effect of each factor. GRA

N80-27324# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
AIR TRAFFIC MANAGEMENT: CIVIL/MILITARY SYSTEM AND TECHNOLOGIES
Feb. 1980 300 p refs Presented at the Guidance and Control Panel Symp., Copenhagen, 9-12 Oct. 1979
(AGARD-CP-273; ISBN-92-835-1347-9) Avail: NTIS

HC A13/MF A01

Various aspects of air traffic on control in civil and military systems and technologies are presented. The specific areas discussed are: (1) operational scene and requirements; (2) civil/military cooperation; (3) aspects of air traffic management philosophy (criteria and human factors; communications and separation); (4) air traffic management in hostile environment; (5) flight management in terminal area; (6) subsystem technology; and (7) advanced systems. For individual titles, see N80-27325 through N80-27347.

N80-27325# Board of Trade, London (England).
AIR TRAFFIC IN NATO EUROPE: ITS CHARACTERISTICS AND ITS NEEDS
I. M. Pedder *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 3 p (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

The needs and characteristics of air traffic in NATO Europe are reviewed. The divergent requirements and particular problems of airspace users are described and it is concluded that efficient use of the airspace can only be achieved through cooperation between the civil and military authorities. Areas where research and development would be fruitful are listed. Author

N80-27326# Army Avionics Research and Development Activity, Fort Monmouth, N. J. Air Traffic Management Systems Div.
HELICOPTER AIR TRAFFIC MANAGEMENT SYSTEMS WITH CIVIL/MILITARY INTEROPERABILITY
Joseph T. Saganowich *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 16 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

In order to achieve significant near-term improvement in the Army's air traffic management capability, several configurations of 'very lightweight air traffic management equipment' (VLATME) were developed. Based upon totally compatible use of today's common civil/military system ATCRBS (air traffic control radar beacon system). Concurrently with the VLATME development, helicopter instrument landing technology work over the past few years has revealed that the key to solving this problem lies in the ability to perform deceleration of the aircraft on instruments, along the approach path, so as to bring the aircraft to a hover a few feet above the intended landing point. The decelerated instrument approach means that helicopter spacings will have to be much smaller than those encountered in fixed wing practice if reasonable flow rates are to be realized. Because of the potential garbling problem in conventional ATCRBS with closely spaced aircraft, a system which integrates the ground and airborne equipments of a scanning beam microwave landing system with the airborne transponder while preserving interoperability was also developed and successfully tested. R.E.S.

N80-27327# Selenia S.p.A., Rome (Italy).
A STUDY FOR DEVELOPMENT OF METHODS FOR AIR TRAFFIC MANAGEMENT
R. Petrioli, S. Pardini, G. Bertoni (Bologna Univ.), and C. Bonivento (Bologna Univ.) *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 14 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

Models and methods for optimal air traffic management were studied as part of the multi-year project 'Navigation aids and air traffic control' funded by the Italian National Research Council (CNR). The scope of the study on the context of CNR project is reviewed. The software structure, its main characteristics and possible utilizations in the planning and management of air traffic system is discussed. Finally, a description is given of more relevant used models and algorithms. R.E.S.

N80-27328# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Human Engineering Dept.
SYSTEM, AIRSPACE, AND CAPACITY REQUIREMENTS FOR FUTURE ATC-SYSTEMS
Ruediger Seifert and Guenther Och *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 15 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

Based on control capacity measurements of various air traffic control (ATC) systems, a theory of control capacity was developed. The theory of control capacity allows comprehensive knowledge to be gained concerning the relationship and interdependence of the following: (1) The airspace configuration (including the present separation requirements), the traffic structure and the resulting conflict probability. (2) The airspace capacity, the control capacity of the ATC control positions (functional units) and their dependence on air traffic structure and the technical ATC system features and capabilities. Using the theory of control capacity, systems of different technical structure were then assessed. Outdated, present day's, and future ATC systems are compared, showing the effect certain technical components and/or system functions have on system capacity. R.E.S.

N80-27329# Civil Aeromedical Inst., Oklahoma City, Okla. Aviation Psychology Lab.
AIR TRAFFIC CONTROL AUTOMATION: ITS IMPACT AND USE IN THE SELECTION AND SCREENING OF AIR TRAFFIC CONTROLLERS
James O. Boone *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 7 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

The impact of automation in air traffic control on personnel screening is discussed. The mathematical and technical aspects as they are currently being developed are focused upon. R.E.S.

N80-27330# Eurocontrol Agency, Brussels (Belgium).
DATA LINK: THE KEY TO IMPROVEMENTS IN CIVIL/MILITARY AIR TRAFFIC MANAGEMENT?
M. E. Cox *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 20 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

Experimental work which is being undertaken both to explore how an air/ground data link might be exploited for future air traffic control purposes and to determine its possible capacity requirements is described. Details of the form and functions of experimental equipment built to investigate what is believed to be the major problem area influencing communications improvements, the pilot/link interface, are given. Details are also given of studies investigating the possible use of the link in transferring aircraft, derived data both to yield improvements in the precision of meteorological forecast data and to enhance the performance of radar-based tracking and conflict-alerting systems. Capacity requirements and the feasibility of realizing a link for these purposes within the next two decades are discussed. R.E.S.

N80-27331# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
MIDAIR CONFLICTS AND THEIR POTENTIAL AVOIDANCE BY PROGRESSIVE IMPLEMENTATION OF AUTOMATION
O. Weber *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 16 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

Actual midair conflicts between civil and military aircraft in German airspace where at least one of the airplanes involved was flying under visual flight rules were analyzed. Operational, environmental and human factors, which contributed to the accidents, and the limits of the 'see and avoid' concept for collision avoidance are discussed. Some shortcomings of the present air traffic control system are mentioned. Taking the actual midair conflicts and some simulated three dimensional flights as examples, the improvement of collision avoidance by progressive implementation of advanced techniques is discussed. The lead time to the potential conflict or to a circular zone of protection, the distance at the closest approach and some other thresholds, estimated by means of a ground-based radar system or an airborne electronic collision avoidance system, are used as main criteria for an automatic conflict alert. Potential advantages of a data link to detect sudden manoeuvres in time are mentioned. R.E.S.

N80-27332# National Aerospace Lab., Amsterdam (Netherlands).
DETERMINATION OF THE SAFETY IN A NORTH ATLANTIC ORGANIZED TRACK SYSTEM WITH REDUCED LATERAL SEPARATION
G. Moek and C. R. Traas *In* AGARD Air Traffic Management:

Civil/Mil. Systems and Technol. Feb. 1980 7 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

Collision risk modelling as related to the reduction of lateral separation from 120 NM to 60 NM at any fixed level in the North Atlantic Organized Track System is considered. Requirements on the navigation performance are described which aircraft must be able to meet if this reduction would be implemented. Two statistical tests are derived which can be applied to the measured number of navigation errors to determine whether the actual navigation performance is such that the system with 60 NM lateral separation meets a target level of safety. The first test which belongs to the standard equipment of the NAT/SPG for judging the safety of the track system is based on one random model for all navigation errors. The second test is applicable for the case different types of navigation errors can be distinguished and modelled separately. The different contribution of each type of error to the total risk is taken into account by the use of weighting factors. This test, however, is still in discussion in the North Atlantic Systems Planning Group. A.R.H.

N80-27333# Army Air Traffic Control Office, APO New York, N.Y. 09056.
US ARMY USERS OUTLOOK ON AIR TRAFFIC MANAGEMENT
William H. Maloney and Larry P. Kreps *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 5 p (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

The need for air traffic control, not only in support of its fixed base peace-time mission, but also its tactical mission is recognized by the U.S. Army. Air traffic management as it existed during the Vietnam era of the 1960's and as it evolved during the 1970's is described. The European scenario literally dictates doctrine for hostile operations in a mid-intensity environment. What is happening and planned from an ATC viewpoint in support of U.S. Army/Europe (USAREUR) is discussed including the future potential of a global positioning system. A.R.H.

N80-27334# Army Avionics Research and Development Activity, Fort Monmouth, N. J. Advanced Avionics Systems Div.
THE DEVELOPMENT AND TEST OF A TACTICAL SELF-CONTAINED LANDING SYSTEM
Norman K. Shupe *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 25 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

The existence of a digital symbol generator (DSG) whose basic function is to compute and display the augmenting symbolic data necessary to operate a helicopter in the NOE environment via a FLIR presentation of the contact world, and a digitally-generated topographic map display (DMG) is sufficient justification to consider adaptation of the DSG and DMG equipments to the reversionary function of providing IMC terrain-following and tactical landing capabilities. The control/display architecture necessary to use a radar altimeter to control the elevation flight path of the aircraft and a Doppler radar to control the deceleration of the aircraft is presented. The assumed precision navigation system provides the Northing/Easting aircraft position: (1) to permit the aircraft to be steered along the prescribed ground track to the landing zone; (2) to provide a starting point for interrogation of the DMG terrain elevation data for purposes of generating anticipation for the TF system; and (3) to act in concert with the velocity output of the Doppler radar for purposes of following a preprogrammed deceleration profile to the landing zone. A multi-phase simulation and flight-test program to assess the performance of the complete system in the NOE environment are described. A.R.H.

N80-27335# Bendix Corp., Detroit, Mich. Communications Div.
VERY LIGHTWEIGHT AIR TRAFFIC MANAGEMENT SYSTEM USING AN ELECTRONIC SCAN ANTENNA
P. J. Woodall and J. L. Shagena, Jr. *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 12 p (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

An electronically scanned antenna with all solid-state interrogator, complemented by a multi-microprocessor driver tactical interactive display, provides a full alphanumeric PPI air traffic management system. This system utilizes the standard Mark X/XII ACTRBS/IFF airborne transponder to provide position information on all targets (up to 100) and tracked range, azimuth, and altitude (via mode C) on up to 13 targets. The two key features of this system are the electronically steered matrix-fed cylindrical array and the microprocessor based intelligent controller. The controller performs search and active track, minimizing interrogator PRF (64-198.5/Sec) and electromagnetic interference. The antenna and R/T are physically integrated into a single assembly to minimize set-up time and maximize reliability. A.R.H.

N80-27336# Elektronik-System G.m.b.H., Munich (West Germany).
TECHNICAL AND OPERATIONAL FACTORS CONCERNING THE LICENSING AND INTRODUCTION OF A NEW MICROWAVE LANDING SYSTEM FOR CATEGORY 2
K. G. Brammer and K. D. Kricke *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 12 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

For the new aircraft Tornado and Alpha-Jet, the landing system SETAC is now being prepared for category 2 service at the assigned air bases in Germany. As soon as this system's technical capabilities are to be exploited to the full extent for operational use, all relevant rules and regulations applicable for ILS category 2 operations must be exhaustively expanded and supplemented. This concerns concepts for infrastructural measures, such as extension of obstacle clearance limits to the whole area of coverage, calibration and testing of the total radio field, modifications of the approach light pattern, additional training and licensing of ATC staff and pilots etc. In order to reduce this extensive task to a short-term solution, a stagewise procedure of system introduction is outlined. The concept is to utilize SETAC equipment with all the corresponding advantages regarding installation, but to retain in the first stage as closely as possible all regulations, flight procedures and instrumentation pertaining to ILS approach and landing. A.R.H.

N80-27337# Systems Control, Inc., West Palm Beach, Fla.
THE INTEGRATION OF AREA NAVIGATION AND THE MICROWAVE LANDING SYSTEM
Donald W. Richardson and Paula M. Rich (FAA, Washington, D.C.) *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 17 p Sponsored by FAA (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

The RNAV and MILS are non-competitive complementary navigation/landing systems that, working together, can markedly enhance the safety and efficiency of terminal area operation while at the same time impacting the overall concept of terminal airspace management. Primarily, these systems afford the opportunity, which has been debated so vigorously for many years, of converting to a distributed management philosophy of ATC system design and operation in which much of the navigation function is transferred from the radar vectors issued by the ground controller to the flight crew, aided by increasingly available, low cost, multifunction avionics systems. Some activities on the part of the United States Federal Aviation Administration to develop and integrate these complementary capabilities into the terminal area airspace system are examined. A.R.H.

N80-27338# Thomson-CSF, Arcueil (France).
SINTAC-C TMA: APPLICATION OF SINTAC-C IN THE TERMINAL AREA, DURING LANDING AND GROUND TAXIING
Lj. Milosevic and J. Hetyei *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 20 p (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

An integrated navigation, traffic control, collision avoidance and communication system is described which can control between 200 and 1000 aircraft according to the number of runways (or airports) included in terminal area. During final approach and landing, the system controls 16 aircraft, the maximum which can be considered in the MLS beam, with a

30 second landing rate. According to the required control capacity, the system uses one, two or three time-shared nets for all the functions and for all the in flight and ground phases. The navigation transmission rates are very high (32-16 Hz) thus ensuring a practically continuous navigation function. The surveillance and synchronization frequency depend on the area: a maximum of 4 seconds in the terminal area and a 1 second maximum at landing time. Three types of SINTAC ground stations are considered: (1) SINTAC-TMA: 100-150 km range covering the TMA area with three or four stations; (2) SINTAC-landing: located at the far-end of the runway (precision DME), range and antenna beam aperture same as MLS; and (3) SINTAC-ground taxiing: airport area coverage by three stations: station range: 5 to 10 km. A.R.H.

N80-27339# Singer-Kearfott, Wayne, N. J.
EVOLUTION AND TRANSITION OF TODAY'S MILITARY LANDING SYSTEM TO COMPATIBILITY WITH PRESENT AND FUTURE CIVIL MILITARY SYSTEMS
Albert J. Shapiro *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 13 p (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

The operational need for a single avionics system to operate with the present instrument landing system, the future ICAO approved microwave landing system and the Marine remote area approach landing system (MRAALS), is discussed. The operational solution developed in response to a U.S. Navy/Marine requirement is a multimode receiver that is capable of operating with any of the systems mentioned above. The evolutionary process involved in progressing from a single to a multiple mode system capability is reviewed with emphasis on the technological advances leading to a most cost and volume effective solution. Author

N80-27340# Hollandse Signaalapparaten N. V., Hengelo (Netherlands).
INTRODUCTION ON LORADS AND ASDE
Erik Chr. Priebee *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 18 p (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

A long range radar and display system (LORADS) and airport surface detection equipment (ASDE) are described. A panoramic view of both systems, its functional and operational requirements, and the system architecture of both the hardware and software are given. M.G.

N80-27341# Ferranti Ltd., Bracknell (England). Computer Systems.
APPLICATIONS OF MICROPROCESSORS IN AIR TRAFFIC c64
David L. Stoddart *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 10 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

The use of microprocessors in air traffic control (ATC) systems is examined. The characteristics of microprocessors are compared with those of mini and main frame computers to identify the most suitable role of the microprocessor in ATC Systems. The application of microprocessors for system functions such as Data Link Management, Display Console Management and Format Converters is discussed. To emphasize the impact of microprocessors on system design a conventional display system is compared with one using microprocessors where this device is built into the overall design of the display system with consequent saving in display generation hardware. The design is extended so that the display microprocessor becomes the central element in display console management. The F100L microprocessor is described in some detail and used as model to define the capability of a microprocessor. M.G.

N80-27342# Royal Signals and Radar Establishment, Malvern (England). Ground Radar and ATC Dept.
PRECISION NAVIGATION FOR AIR TRAFFIC MANAGEMENT
S. Ratcliffe *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 5 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

The problems that would arise if airspace users had the use of NAVSTAR or some other much better position-fixing aid than at present, and the uses that air traffic control (ATC) could or could not make of this capability are examined. There would be formidable transitional problems in the vertical plane, because NAVSTAR measures height from the Earth's center whereas current altimeters measure atmosphere pressure. In either vertical or horizontal planes much work would be necessary to prove that the separation standards can be reduced at all. The changes that might be possible in the ATC system should appreciable reductions in separation standards prove possible are discussed. NAVSTAR might form the basis of a collision avoidance system based on either the broadcast coordinates of each aircraft or on a time frequency basis using NAVSTAR as the time reference. The latter scheme would offer protection of a fully equipped aircraft against threat that could not afford the expense of a NAVSTAR fit. M.G.

N80-27343# Mitre Corp., Bedford, Mass.
JTIDS: AN INTEGRATED COMMUNICATIONS NAVIGATION AND IDENTIFICATION SYSTEM, AND ITS POTENTIAL FOR AIR TRAFFIC MANAGEMENT
Donald D. Neuman *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 13 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

The integrated data communications, voice communications, navigation, and identification features of the Joint Tactical Information Distribution System (JTIDS) are described with emphasis on those features applicable to air traffic management. The JTIDS system architecture simultaneously provides data at the ground centers and in the cockpit. Airspace control and advisory data are made available to all aircraft to permit subscribers to be aware of, and comment upon, directions provided to others. Network control techniques are discussed which support civil air traffic management applications. These techniques provide for the apportionment of capacity among subscribers in such a manner as to allow all subscribers access to all data in their area of interest without real time network management. The potential exists for a substantial reduction in the avionics boxes aboard aircraft. A JTIDS like system can simultaneously provide the data for airspace management and control, collision avoidance, area navigation, air-to-air coordination, cooperative surveillance, cockpit situation display, airport surface traffic control, and possibly instrument landing. The transition from the existing air traffic management system to a JTIDS like system is also addressed. Austere terminal designs appear to be possible at a cost that is affordable for general aviation. M.G.

N80-27344# Federal Aviation Administration, Washington, D. C. Systems Research and Development Service.
DISCRETE ADDRESS BEACON SYSTEM
P. D. Hogkins *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 10 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

A discrete address beacon system (DABS) to provide upgraded air traffic control radar beacon system (ATCRBS) surveillance is discussed. The DABS concept provide improved air traffic control automation service and ground based automatic traffic advisory and resolution service through its integral high capacity digital air ground data link. The compatibility of DABS with ATCRBS, interrogation concepts, and the computer processing subsystem are specifically discussed and current testing and evaluations of the system are reviewed. M.G.

N80-27345# Royal Signals and Radar Establishment, Malvern (England).
ADSEL: SELECTIVE ADDRESS SSR, PERFORMANCE OF THE EVALUATION STATION
R. C. Bowes, T. B. Nichols, and J. M. Bonny *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 8 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

A selectively addressed radar system (ADSEL) designed to overcome the 'garble' problem of the current secondary surveillance radar (SSR) system and provide a data link facility is

discussed. The system requires aircraft to carry a transponder which includes the selective address mode of operation and a ground station with monopulse direction finding system plus data processing facilities. In particular the evaluation trials that have been carried out are reviewed and the results of a large number of aircraft flights are given. The main aim of the trials is to assess the accuracy with which the position of an aircraft can be measured, the performance of the communication links, and to optimise the operating rules. A detailed analysis is given of the performance of the SSR and ADSEL system when monitoring two aircraft flying close together such that their transponder replies were 'garbling'. M.G.

N80-27346# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SURVEILLANCE PERFORMANCE MEASUREMENTS OF THE SSR MODE OF THE DISCRETE ADDRESS BEACON SYSTEM
Vincent A. Orlando and Paul R. Drouilhet *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 11 p refs Sponsored by FAA (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

The field measurements, taken to evaluate the surveillance performance of the Discrete Address Beacon System (DABS), are described. Simultaneous measurements made by transportable measurements facilities and the existing ground stations provided the opportunity for a side-by-side comparison of DABS off-boresite monopulse and conventional surveillance measurement performance. The results indicate that both range and azimuth accuracies of the DABS design are four times better than those provided by current terminal secondary surveillance radar (SSR) equipment. Blip/scan ratio for monopulse SSR is 98% or better, and remains high in crossing track situations where the performance of existing equipment is observed to degrade. Significantly, this improvement in SSR performance was accomplished with 1/4 the pulse repetition frequency of the present equipments. M.G.

N80-27347*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTIVENESS OF ADVANCED FUEL-CONSERVATIVE PROCEDURES IN THE TRANSITIONAL ATC ENVIRONMENT
L. Tobias and Paul J. Obrien (National Aviation Facilities Experimental Center, Atlantic City, N.J.) *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 14 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01 CSCL 17G

The real time simulation (involving both the pilot and the air traffic controller) of fuel conservative approaches, profile descents, and four dimensional area navigation to assess the effectiveness of the procedures is discussed. Generally, results indicate some difficulties with the procedures tested in a mixed traffic environment and point to the need for computer assistance for effective implementation of candidate procedures. M.G.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N80-27348 Washington Univ., Seattle.
EFFECT OF SOME STRUCTURAL PARAMETERS ON ELASTIC ROTOR LOADS BY AN ITERATIVE HARMONIC BALANCE Ph.D. Thesis
Abraham Eipe 1979 122 p
Avail: Univ. Microfilms Order No. 8012195

The coupled flap-lag equations of motion for an elastic helicopter blade in forward flight are derived including several structural coupling parameters. These nonlinear equations of motion are solved by an iterative harmonic balance method. Depending on the nature of the rotor load trim, the equations for the steady thrust and roll and pitch moments are also solved simultaneously with the flap equation of motion to obtain the unknown control settings. Once the generalized coordinates and the control settings are known the rotor load harmonics are computed by Fourier analysis. Effects of various structural coupling parameters on rotor loads are studied for three typical rotors: a stiff in-plane hingeless tail rotor, a soft in-plane hingeless main rotor, and an articulated main rotor. The results show excellent convergence of the iterative solution scheme. Dissert. Abstr.

N80-27349 California Univ., Los Angeles.
MULTILEVEL OPTIMUM DESIGN OF WING BOX STRUCTURES WITH FIBER COMPOSITE PANEL COMPONENTS Ph.D. Thesis
Massood Mehrinfar 1980 180 p
Avail: Univ. Microfilms Order No. 8016018

A multilevel approach is used which considers the overall sizing of the structure using equivalent thickness type design variables as a system level task while detailed design is carried out at the component level for each individual panel. The total structural weight is taken as the system level objective function while the change in equivalent system stiffness is taken to be the objective function for each of the uncoupled component level problems. The key idea is to select the component level objective function so as to minimize change in component loads due to subsequent force redistribution, accomplished by taking the change in stiffness as the component level objective function to be minimized. Finite element analysis is used at the system level to compute the internal forces. Each fiber composite panel is modelled by stacking layers of orthotropic assumed stress rectangular elements representing equivalent thicknesses. Approximation concepts such as linking, constraint deletion, and explicit approximations of retained constraints are employed. A quadratic extended interior penalty function formulation is used as the optimization tool at both the system and component design modification levels. Dissert. Abstr.

N80-27350*# Hydraulic Research Textron, Valencia, Calif.
FLIGHTWORTHY ACTIVE CONTROL LANDING GEAR FOR A SUPERSONIC AIRCRAFT Final Report
Irving Ross Washington NASA Jun. 1980 141 p ref (Contract NAS1-15455)
(NASA-CR-3298) Avail: NTIS HC A07/MF A01 CSCL 01C

A flightworthy active control landing gear system for a supersonic aircraft was designed to minimize aircraft loads during takeoff, impact, rollout, and taxi. The design consists of hydromechanical modifications to the existing gear and the development of a fail-safe electronic controller. Analytical results indicate that for an aircraft sink rate of 0.914 m/sec (3 ft/sec) the system achieves a peak load reduction of 36% during landing impact. L.F.M.

N80-27351*# National Aeronautics and Space Administration, Washington, D. C.
MEASURES FOR IMPROVING THE ZEPPELIN AIRSHIPS FOR LONG DISTANCE TRANSPORTATION
Ludwig Ferdinand Duerr Apr. 1980 19 p Transl. into ENGLISH of "Gedenken an die Hundertste Wiederkehr des Geburtstages des Grafen Zeppelin", Deutschen Akademie der Luftfahrtforschung, West Germany, 17 Jun. 1938 p 15-30 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76142) Avail: NTIS HC A02/MF A01 CSCL 01C

Factors to be considered in the construction of dirigibles include the design and weight of support structures, static and aerodynamic loads on the main ring, the annealing of support materials, and the dynamic gas pressure. Adaptations made for using helium as the lifting gas, and a method for extracting ballast are described. A.R.H.

N80-27352# Ballistic Research Labs., Aberdeen Proving Ground, Md.
MUZZLE BLAST OVERPRESSURE LEVELS ON THE AH-1S HELICOPTER TOW SIGHT UNIT Final Report
Edward M. Schmidt and Edmund J. Gion Mar. 1980 32 p Supersedes ARBRL-IMR-620
(DA Proj. 1L1-61102-AH-43)
(AD-A084027; AD-E430410; ARBRL-MR-02997;

ARBRL-IMR-620) Avail: NTIS HC A03/MF A01 CSCL 19/1

An experimental program was conducted to measure the muzzle blast overpressures upon a simulated AH-1S Helicopter TOW Sight Unit (TSU). Different weapon configurations were fired to examine the effect of gun caliber and the presence of muzzle devices. Surface pressure distributions were measured along the line of symmetry of the TSU and were supplemented by spark shadowgraphs of the blast wave propagation. Limited data was acquired in the BRL Aerodynamics Range to measure the trajectory perturbation association with the internal gas dynamics of the muzzle devices. GRA

N80-27353# McDonnell Aircraft Co., St. Louis, Mo.

THE F-4 SERVICE LIFE TRACKING PROGRAM CRACK GROWTH GAGES Final Report, Feb. 1978 - Sep. 1979

C. R. Saff Wright-Patterson AFB, Ohio AFFDL Dec. 1979 138 p refs

(Contract F42600-78-D-0014; AF Proj. 2401)

(AD-A083978; AFFDL-TR-79-3148) Avail: NTIS HC A07/MF A01 CSCL 01/3

The objective of this program was to evaluate the ability of a crack growth gage to monitor potential crack growth damage in fatigue critical locations of F-4C/D aircraft structure. Crack growth gages were designed for use on the lower wing skin of F-4 aircraft. An element test program was performed to verify gage design and provide data for predicting gage behavior when attached to the fatigue test article. Results of those tests prompted performance of a supplemental test program to investigate effects of sheet thickness on crack growth retardation. Results from both of these test programs were used to develop procedures to predict crack growth in gages attached to the fatigue test article. Eight gages were bonded to the test article using room temperature cure adhesive after an elevated cure temperature adhesive failed. Results show gage crack growth is predictable. Analysis results demonstrate the monitoring potential of the gage. GRA

N80-27354# Boeing Vertol Co., Philadelphia, Pa.

STUDY OF COST/BENEFIT TRADEOFFS AVAILABLE IN HELICOPTER NOISE TECHNOLOGY APPLICATIONS Final Report

R. H. Spencer and H. Sternfeld, Jr. Jan. 1980 34 p refs

(Contract DOT-FA78WA-4161)

(AD-A083955; FAA/EE-80-5) Avail: NTIS HC A03/MF A01 CSCL 01/3

This study investigated cost/benefit tradeoffs using the case histories of four helicopters for which design and development were complete, and in three cases, have undergone substantial flight testing. The approach to quieting each helicopter was an incremental reduction of each source as required to obtain reductions in flyover noise with modifications to other secondary systems only as necessary. The methodology used to predict the effects of the design modifications on acquisition, maintenance, and operating costs were typical of those employed by rotorcraft manufacturers. The reduction of helicopter flyover noise generally was achieved through reductions in rotor tip speed. Performance characteristics were maintained to specified minimums for each aircraft in the study. GRA

N80-27355# Federal Aviation Administration, Washington, D. C. Office of Environment and Energy.

ENERGY CONSERVATION POTENTIAL OF GENERAL AVIATION ACTIVITY

Sep. 1979 52 p refs

(AD-A081182; FAA/EE-79-20) Avail: NTIS HC A04/MF A01 CSCL 01/2

Three approaches for reducing energy consumption were investigated: hardware modification, pilot education, and air traffic control. It is recommended that research into new aircraft engine designs, automatic mixture controls, conventional engine fuel saving improvements, composite materials development, and aerodynamic drag reduction continue and that this hardware be introduced into the fleet when cost, reliability and safety considerations allow. It is further recommended that the pilot awareness and education programs listed above be implemented by the FAA and the general aviation industry; and finally, that the ATC actions listed should be further evaluated to determine whether the anticipated fuel savings justify their implementation. GRA

N80-27356# Noah (J. Watson) Associates, Inc., Falls Church, Va.

COSTS AND BENEFITS OF REQUIRING NEW PRODUCTION OF OLDER AIRCRAFT TYPES TO MEET AMENDED NOISE STANDARDS Final Report

C. F. Day and E. D. Studholme Sep. 1979 76 p refs

(Contract DOT-FA78WA-4192)

(AD-A080130; FAA/EE-79-22) Avail: NTIS HC A05/MF A01 CSCL 01/3

This report examines costs and benefits associated with requiring new production of older aircraft models to meet amended noise standards. Two cases are examined: (1) all aircraft produced after 1983 must meet a noise emission standard halfway between Stage 2 and Stage 3 limits; and (2) all aircraft produced after 1985 must meet Stage 3 noise standards. The cost elements are combined and expressed as a change in direct operating costs in either cost-per-passenger mile or cost-per-aircraft mile, as appropriate. Noise benefits are estimated in terms of the change in area under a 100 EPNL contour resulting from the amended standards. GRA

N80-27357# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.

COST/BENEFIT TRADEOFFS AVAILABLE IN AIRCRAFT NOISE TECHNOLOGY APPLICATIONS IN THE 1980'S Final Report

John F. Wilby and William J. Galloway Dec. 1979 175 p refs

(Contract DOT-FA77WA-4037)

(AD-A082028; BBN-3856; FAA/EE-80-2) Avail: NTIS HC A08/MF A01 CSCL 01/3

The current status of aircraft noise control technology is reviewed to identify those measures that have a reasonable potential for application to aircraft coming into service in the 1980's. Noise reduction achievable when these noise control measures are applied to two transport category airplanes, a business jet, and a small propeller-driven twin is determined. Costs and performance penalties are determined for each noise control option. Benefits are measured by reductions in FAR 36 certification noise levels and in reductions in EPNL contour areas. The study shows that current, late 1970's, noise control practices permit transport category airplanes to meet the FAR 36 Stage 3 noise limits, yet application of additional noise control measures is not likely to provide additional reduction of the noise levels for these aircraft by more than 3 decibels. New business jet noise levels will be as much as 10 decibels lower than Stage 3 limits for takeoff, and as much as 5 decibels lower on approach, with additional reductions of more than 3 decibels unlikely. Introduction of newly designed, geared reciprocating engines would provide reductions of 10 or more decibels for high performance single and twin-engined, propeller-driven small airplanes, relative to existing practice. GRA

N80-27358# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

QUATERNION UTILIZATION IN A MISSILE MODEL M.S. Thesis

William John Thome Mar. 1980 105 p

(AD-A084263; AFIT/GST/MA/80M-3) Avail: NTIS HC A06/MF A01 CSCL 16/4

The air-to-air missile model used by the Cruise Missile Independent Survivability Team did not contain data useful to the cruise missile. The objective of this study was to modify the subroutine SIGNAL in the model to incorporate the cruise missile data. The modification required an understanding of quaternion algebra utilized within the model to represent three dimensional motion. These quaternions allow real time outputs from the model for use by tactical ranges. The study contains a discussion of quaternions and their algebra. GRA

N80-27359# General Electric Co., Burlington, Vt. Armament Systems Dept.

AIR TO AIR HELICOPTER FIRE CONTROL EQUATIONS AND SOFTWARE GENERATION Final Report, 20 Dec. 1978 - 31 Aug. 1979

John W. Carlson, David B. Ellis, Theresa Parisi, and Abbas A. Rizvi Nov. 1979 111 p
(Contract DAAK10-79-C-0028)
(AD-A084115; Doc-80AP8508) Avail: NTIS HC A06/MF A01 CSCL 19/5

Fire control equations suitable for use in a helicopter air-to-air gunnery engagement are developed. Maximum use is made of existing software from the Closed Loop Fire Control System (CLFCS). New target state estimator, ballistics, and gun order modules are developed to account for target motion effects. The resulting software was coded and run in the CLFCS fire control computer, and made to interface with a modified Multiweapon Fire Control System. GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-27360*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT INVESTIGATION OF COCKPIT-DISPLAYED TRAFFIC INFORMATION UTILIZING CODED SYMBOLOGY IN AN ADVANCED OPERATIONAL ENVIRONMENT
Terence S. Abbott, Gene C. Moen, Lee H. Person, Jr., Gerald L. Keyser, Jr., Kenneth R. Yenni, and John F. Garren, Jr. Jul. 1980 31 p refs
(DA Proj. 1L2-62209-AH-76)
(NASA-TP-1684; AVRADCOM-TR-80-B-4; L-13584) Avail: NTIS HC A03/MF A01 CSCL 01D

Traffic symbology was encoded to provide additional information concerning the traffic, which was displayed on the pilot's electronic horizontal situation indicators (EHSI). A research airplane representing an advanced operational environment was used to assess the benefit of coded traffic symbology in a realistic work-load environment. Traffic scenarios, involving both conflict-free and conflict situations, were employed. Subjective pilot commentary was obtained through the use of a questionnaire and extensive pilot debriefings. These results grouped conveniently under two categories: display factors and task performance. A major item under the display factor category was the problem of display clutter. The primary contributors to clutter were the use of large map-scale factors, the use of traffic data blocks, and the presentation of more than a few airplanes. In terms of task performance, the cockpit-displayed traffic information was found to provide excellent overall situation awareness. Additionally, mile separation prescribed during these tests. L.F.M.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-27361*# Curtiss-Wright Corp., Wood-Ridge, N.J.
PERFORMANCE, EMISSIONS, AND PHYSICAL CHARACTERISTICS OF A ROTATING COMBUSTION AIRCRAFT ENGINE, SUPPLEMENT A
R. K. Lamping, I. Manning, D. Myers, and B. Tjoa May 1980 74 p
(Contract NAS3-20808)
(NASA-CR-135119; CW-WR-76-028.3) Avail: NTIS HC A04/MF A01 CSCL 21E

Testing was conducted using the basic RC2-75 engine, to which several modifications were incorporated which were designed to reduce the hydrocarbon emissions and reduce the specific fuel consumption. The modifications included close-in surface gap spark plugs, increased compression ratio rotors, and provisions for utilizing either side or peripheral intake ports, or a combination of the two if required. The proposed EPA emissions requirements were met using the normal peripheral porting. The specific fuel economy demonstrated for the modified RC2-75 was 283 g/kW-hr at 75% power and 101 brake mean effective pressure (BMEP) and 272.5 g/kW-hr at 75% power and 111 BMEP. The latter would result from rating the engine for takeoff at 285 hp and 5500 rpm, instead of 6000 rpm. E.D.K.

N80-27362*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPOSITE WALL CONCEPT FOR HIGH TEMPERATURE TURBINE SHROUDS: HEAT TRANSFER ANALYSIS
Francis S. Stepka and Lawrence P. Ludwig 1980 17 p refs Presented at Aerospace Congr., Los Angeles, 13-16 Oct. 1980; sponsored by Soc. of Automotive Engr.
(NASA-TM-81539; E-402) Avail: NTIS HC A02/MF A01 CSCL 21E

A heat transfer analysis was made of a composite wall shroud consisting of a ceramic thermal barrier layer bonded to a porous metal layer which, in turn, is bonded to a metal base. The porous metal layer serves to mitigate the strain differences between the ceramic and the metal base. Various combinations of ceramic and porous metal layer thicknesses and of porous metal densities and thermal conductivities were investigated to determine the layer thicknesses required to maintain a limiting temperature in the porous metal layer. Analysis showed that the composite wall offered significant air cooling flow reductions compared to an all impingement air cooled, all metal shroud. Author

N80-27363*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NUMERICAL CALCULATION OF TRANSONIC AXIAL TURBOMACHINERY FLOWS
Djordje S. Dulikravich 1980 10 p refs Presented at 7th Intern. Conf. on Numerical Methods in Fluid Dyn., Stanford, Calif., 23-27 Jun. 1980, sponsored by NASA, AFOSR, NSF, and ONR
(NASA-TM-81544; E-500) Avail: NTIS HC A02/MF A01 CSCL 21E

A numerical method and the results of a computer program are presented for solving an exact, three dimensional, full potential equation that models rotating and nonrotating inviscid, absolutely irrotational, homentropic flows. Besides calculating the flows through an arbitrarily shaped rotor or stator blade row mounted on an axisymmetric hub and confined in an axisymmetric duct, the computer program is also capable of analyzing flow fields about arbitrarily shaped wing body combinations, propellers, helicopter rotors in hover, and wind turbine rotors. The governing equation is solved numerically in a fully conservative form by using an artificial time concept, a finite volume technique, rotated type dependent differencing, successive line overrelaxation, and sequential boundary conforming grid refinement. An artificial viscosity is added in fully conservative form, and an initial guess for the potential field is applied, as determined by a two dimensional cascade analysis. Author

N80-27364*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
CF6-6D ENGINE PERFORMANCE DETERIORATION
Ray H. Wulf, W. H. Kramer, J. E. Pass, and J. J. Smith Jan. 1980 286 p refs
(Contract NAS3-20631)
(NASA-CR-159786; R80AEG218) Avail: NTIS HC A13/MF A01 CSCL 21E

Cruise cockpit recordings and test cell performance data in conjunction with hardware inspection data from airline overhaul shops were analyzed to define the extent and magnitude of performance deterioration of the General Electric CF6-6D model engine. These studies successfully isolated short-term deterioration from the longer term, and defined areas where a significant reduction in aircraft energy requirements for the 1980's can be realized. Unrestored losses which remain after engine refurbishment represent over 70% of the loss at engine shop visit. Sixty-three percent of the unrestored losses are cost-effective to restore which could reduce fuel consumed by CF6-6D engines in 1980 by 10.9 million gallons. Author

N80-27365*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LOSS MODEL FOR OFF-DESIGN PERFORMANCE ANALYSIS OF RADIAL TURBINES WITH PIVOTING-VANE, VARIABLE-AREA STATORS
Peter L. Meitner and Arthur J. Glassman 1980 22 p refs Proposed for presentation at the Aerospace Congr., Los Angeles, 13-16 Oct. 1970; sponsored by the Society of Automotive Engineers Prepared in cooperation with Army Aviation Research and Development Command, Cleveland
(NASA-TM-81532; AVRADCOM-TR-80-C-15; E-455) Avail: NTIS HC A02/MF A01 CSCL 21E

An off-design performance loss model is developed for variable-area (pivoted vane) radial turbines. The variation in stator loss with stator area is determined by a viscous loss model while the variation in rotor loss due to stator area variation (for no stator end-clearance gap) is determined through analytical matching of experimental data. An incidence loss model is also based on matching of the experimental data. A stator vane end-clearance leakage model is developed and sample calculations are made to show the predicted effects of stator vane end-clearance leakage on performance. Author

N80-27366# United Technologies Corp., Windsor Locks, Conn.
INFLUENCE OF NOISE REDUCTION ON WEIGHT AND COST OF GENERAL AVIATION PROPELLERS Final Report
Robert J. Klatte and Frederick B. Metzger Jun. 1979 111 p refs
(Contract DOT-FA78WA-4111)
(AD-A082120; FAA-AEE-79-18) Avail: NTIS HC A06/MF A01 CSCL 01/3

Results of a study are reported in which the influence of noise reduction on weight and cost of propellers used in General Aviation aircraft was evaluated. Aircraft performance was not to be degraded by installation of the reduced noise propellers. Only propeller modifications were permitted. Engine modifications, such as introduction of a gearbox to reduce noise by reduction of RPM, were not permitted in the study. Major factors in noise reduction found promising in the study were (1) optimization of performance by use of the best available airfoils, (2) use of thin airfoils and a narrow elliptical tip blade planform, and (3) increasing the number of blades consistent with maintaining aircraft performance. For the three aircraft studied (a single engine, a light twin and a heavy twin) the flyover noise reduction potential varied from 3 to 8 dBA with no weight or cost penalty. Greater reductions in noise resulted in increased weight and/or cost penalties. Also, in some cases, engine noise would have to be reduced to achieve greater reductions. The progress by General Aviation aircraft manufacturers in reducing noise is indicated by the finding that the most recent aircraft design had the smallest noise reduction potential. GRA

N80-27367# Science Applications, Inc., Canoga Park, Calif.
AFOSR CONTRACTORS MEETING ON AIR-BREATHING COMBUSTION DYNAMICS AND KINETICS, 1979 ABSTRACTS
R. B. Edelman 1 Feb. 1980 159 p refs Conf. held in Alexandria, Va., 28 Jan. - 1 Feb. 1980
(Contract F49620-77-C-0044; AF Proj. 2308)
(AD-A083651; AFOSR-79-1173TR) Avail: NTIS HC A08/MF A01 CSCL 21/5

The report consists of a collection of abstracts of the numerous research progress reports given by AFOSR contractors and of invited papers from other governmental agencies and contractors. These papers presented over a five day period composed the 1979 annual contractors meeting on Air-Breathing Combustion Dynamics and Kinetics. The principal investigators and their organizational association are also identified. GRA

N80-27368# Pennsylvania State Univ., University Park. Applied Research Lab.
DOCUMENTATION OF CASCADE UNSTEADY PRESSURE DIFFERENCE PROGRAM
I.-C. Shen 5 Jan. 1980 46 p refs
(Contract N00024-79-C-6043)
(AD-A083987; ARL/PSU-TM-80-10) Avail: NTIS HC A03/MF A01 CSCL 21/5

The response of an axial flow turbomachine to spatial velocity variations can be determined by the unsteady pressure distribution function which has been developed and represents an extension of an earlier analysis of the unsteady lift. A computer program has been written to formulate the unsteady pressure difference as a function of design parameters. This program is versatile in that it includes the effects of the cascade geometrical parameters and disturbance flow characterisitics, such as the blade camber, angle of incidence, nonconvected disturbance, and it also gives the unsteady lift and moment. The documentation and the use of this program are presented herein. GRA

N80-27369# Pennsylvania State Univ., University Park. Applied Research Lab.
NATURE OF INLET TURBULENCE AND STRUT FLOW DISTURBANCES AND THEIR EFFECT ON TURBOMACHINERY NOISE
R. Trunzo, B. Lakshminarayana, and D. E. Thompson 25 Feb. 1980 64 p refs
(Contract N00024-79-C-6043)
(AD-A084355; ARL/PSU-TM-80-20) Avail: NTIS HC A04/MF A01 CSCL 21/5

Results of an investigation in which turbomachinery rotor sound spectra were correlated with aerodynamic measurements of the inlet turbulence, strut wake, and vortex flow strengths are reported. Aerodynamic measurements included mean velocity profiles, turbulence intensity, and axial length scales. Inlet turbulence data indicate that the major effect of flow contraction appears to be the elongation of turbulent eddies from 20 cm to 200 cm. Eddies of this size dominate the blade passing frequency (BPF) tones. Decreasing eddy size by use of a grid revealed vortex flow strength to be the second major sound source. A doubling of vortex flow strength produced a 6 dB increase in the SPL of the first BPF. The sound pressure level showed less than a 2 dB change with doubling of wake turbulence intensity or velocity defect. A discussion of the relative importance of various sources of noise due to flow distribution at the inlet is given. This report will be submitted to the Journal of Sound and Vibration for publication. GRA

N80-27370# Detroit Diesel Allison, Indianapolis, Ind.
HIGH-TEMPERATURE RADIAL TURBINE DEMONSTRATION Final Report, 15 Jun. 1977 - 15 Nov. 1979
B. A. Ewing and Donald S. Monson Apr. 1980 204 p refs
(Contract DAAJ02-77-C-0031; DA Proj. 1L2-62209-AH-76)
(AD-A084120; DDA-EDR-9990; USAAVRADCOM-TR-80-D-6)
Avail: NTIS HC A10/MF A01 CSCL 21/5

The objective of this program was to provide and demonstrate the technology required to economically manufacture a cooled, high temperature, radial turbine with sufficient integrity and aerodynamic performance to meet future Army requirements for a reliable, low-cost, high performance, small gas turbine engine. The work to accomplish this objective was subdivided into three phases. GRA

N80-27371# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
COMBUSTOR MODELLING
Feb. 1980 377 p refs In ENGLISH and FRENCH Meeting held in Cologne, 3-5 Oct. 1979
(AGARD-CP-275; ISBN-92-835-0260-4) Avail: NTIS HC A17/MF A01

Twenty-four papers addressing the different models and methods used in turbine engine research are presented. Four general areas are discussed: basic phenomena, transient phenomena and instabilities, furnaces and boilers, and gas turbine combustors and R/H systems. For individual titles, see N80-27372 through N80-27395.

N80-27372# Societe Nationale d'Etudes et de Construction de Moteurs d'Aviation, Moissy-Cramayel (France). Dept. du Combustion.
MODELING THE COMBUSTION CHAMBER OF A GAS TURBINE: A MECHANICS VIEWPOINT [MODELISATION DES FOYERS DE TURBOREACTEURS: POINT DE VUE D'UN MOTORISTE]
Ph. Gastebois *In* AGARD Combustor Modelling Feb. 1980 7 p refs In FRENCH (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

Two objectives must be met when modeling combustion chambers for gas turbines. The optimization of combustion chambers presently directed towards the reduction of pollutant emissions, but which can be directed towards performance, stability, and relighting, must take into consideration the characteristics of the injection system, the primary zone, and the dilution. In addition, the prediction of combustion chamber performances should also permit the prediction of the characteristics of the outlet temperature, the wall temperature, and of the polluting emissions. To fill these two objectives, the mechanical engineer wants two types of models: a simplified one for performance estimation, and a more thorough model for optimizing the architecture of the combustion chamber. In both cases, a better knowledge of the physical phenomena (radiation, transfer, and reaction kinetics) obtained from improved measurements is indispensable. Transl. by A.R.H.

N80-27373# Sheffield Univ. (England). Dept. of Chemical Engineering and Fuel Technology.

***FUNDAMENTAL MODELLING OF MIXING, EVAPORATION* AND KINETICS IN GAS TURBINE COMBUSTORS**

J. Swithenbank, A. Turan (Science Applications, Inc., Woodland Hills, Calif.), P. G. Felton, and D. B. Spalding (Imperial Coll. of Science and Technology) *In* AGARD Combustor Modelling Feb. 1980 21 p refs (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

Past achievements current status and future prospects of combustor modeling are discussed. The past achievements largely consist of detailed studies of idealized flames which have given an understanding of the relevant fundamental processes. However, gas turbine combustor computations must include the simultaneous interacting processes of three dimensional two-phase turbulent flow, evaporating droplets, mixing, radiation and chemical kinetics. At the present time numerical prediction algorithms are becoming available which can model all these processes to compute the hydrodynamic, thermodynamic and chemical quantities throughout a three dimensional field. Complementary stirred reactor network algorithms permit the prediction of minor constituents (pollutants), again including such effects as droplet evaporation and unmixedness. Experimental verification of these various predictions reveals remarkably good agreement between measured and predicted values of all parameters in spite of the physical and mathematical assumptions currently used. Future problems include: more accurate modeling of turbulence/kinetic interactions, numerical procedure optimization and detailed measurements of residence time distribution and two-phase parameters in real, hot combustors. R.E.S.

N80-27374# Imperial Coll. of Science and Technology, London (England). Dept. of Chemical Engineering and Chemical Technology.

MATHEMATICAL MODELLING OF GAS-TURBINE COMBUSTION CHAMBERS

W. P. Jones and J. J. McGuirk *In* AGARD Combustor Modelling Feb. 1980 11 p refs Sponsored by Rolls-Royce Ltd. (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

A mathematical model for predicting the performance of gas turbine combustion chambers is described. The model is based on the finite difference solution of the averaged forms of the governing partial differential conservation equations and turbulent transport is approximated via a variable density form of the k-epsilon turbulence model. The reactions associated with heat release are assumed sufficiently fast for chemical equilibrium to prevail on an instantaneous basis; and the influence of local turbulent fluctuations in mixture strength accounted for by a beta-probability density function. Liquid fuel sprays are represented by a transport equation for the probability density function describing the variation of droplet mass fraction with droplet radius. Computations of 2-d axisymmetric and 3-d flows are compared with experimental results and an assessment made of the adequacy of the various submodels embodied in the prediction procedure. Author

N80-27375# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

***A PREDICTION MODEL FOR TURBULENT DIFFUSION* FLAMES INCLUDING NO-FORMATION**

J. Janicka (RWTH, Aachen, West Germany) and W. Kollmann *In* AGARD Combustor Modelling Feb. 1980 17 p refs (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

A prediction model for turbulent diffusion flames burning gaseous fuels was developed and applied to H2-air flames. In the (simplified) system of chemical reactions the fast reactions are assumed in equilibrium, equilibrium whereas three-body recombinations are treated in non-equilibrium. For the H2-air flames this assumption leads to a description of the reacting system with only two variables f and r. Two methods of treating such a system in a turbulent flow are discussed: (1) modeling and solving transport equations for first and second order moments of these variables and prescribing the form of the pdf of f and r as a function of the selected moments, or (2) modeling and solving the equation for the pdf of f and r. Both sets of equations are complemented with a modified version of the k-epsilon turbulence model. The NO-formation in such flames can be calculated using the non-equilibrium values (mean values and covariances) of the O and H radicals. The results obtained with both models are compared with experiment and show good agreement. R.E.S.

N80-27376# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Antriebstechnik.

TURBULENT REACTION AND TRANSPORT PHENOMENA *IN JET FLAMES*

H. Eickhoff, K. Grethe (Karlsruhe Univ.), and F. Thiele (Technische Univ., Berlin, West Germany) *In* AGARD Combustion Modelling Feb. 1980 11 p refs (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

A new reaction model accounting for intermediate species was applied in connection with the k-epsilon model to predict different free and enclosed turbulent natural gas flames. The reaction model is based on the assumption of a quasilaminar flame substructure of a turbulent diffusion flame and a probability density distribution of fuel-atom-concentration. It is assumed, that the quasilaminar flames are in local chemical equilibrium within zones of finite thickness. The influence of variable density on the mixing process was studied for different jets and jet flames. In the parabolic flow cases it was found necessary to account for variable density which was done by a mixing length relation. Different numerical procedures were applied for the parabolic and elliptic flow fields. Author

N80-27377# Karlsruhe Univ. (West Germany). Inst. fuer Thermische Stroemungsmaschinen.

***ON THE PREDICTION OF TEMPERATURE PROFILES AT* THE EXIT OF ANNULAR COMBUSTORS**

Osama M. F. Elbahar and Sigmar L. K. Wittig *In* AGARD Combustor Modelling Feb. 1980 9 p refs (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

Despite their inherent limitations, two dimensional prediction procedures based on solving the basic equations and incorporating the k-epsilon model of turbulence are shown to be effective tools in designing annular combustors. In comparing the results it was found that predictions from available jet mixing correlation data within certain limitations represent measurements from single row injection more accurately. Detailed calculations, however, are more effective in predicting opposite wall cooling air injection, multiple row jet mixing, heat transfer, film cooling and the effects of converging combustor exit. R.E.S.

N80-27378# Aeronautical Research Associates of Princeton, Inc., N. J.

SECOND-ORDER CLOSURE MODELING OF TURBULENT *MIXING AND REACTING FLOWS*

Ashok K. Varma, Guido Sandri, and Coleman duP. Donaldson *In* AGARD Combustor Modelling Feb. 1980 13 p refs (For primary document see N80-27371 18-07)

(Contracts N00014-75-C-1143; N00014-79-C-0335; F44620-76-C-0048; Proj. SQUID)

Avail: NTIS HC A17/MF A01

Models for the scalar probability density function (PDF) have to be developed to achieve closure of turbulent transport equations for mixing and reacting flows. A delta function typical eddy model was developed for the joint PDF of the scalar variables. It was demonstrated that delta functions are a necessary part of PFTs in order to attain the extremums of the statistical constraints on the moments. The statistical bounds on a number of moments of interest for two and three species flows were derived. It was proven that a rational PDF composed of a set of delta functions alone can always be constructed at any point within the statistically valid moment space. The model provides a good representation of actual PDFs in two species, variable density, mixing flows. The model was directly compared to experimental PDF measurements and good agreement for higher order moments was demonstrated. It can be shown that the delta function PDF model is significantly simpler than other proposed PDF models and is more than adequate for the closure of the transport equations. E.D.K.

N80-27379*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

COMBUSTOR MODELLING FOR SCRAMJET ENGINES

J. Philip Drummond, R. Clayton Rogers, and John S. Evans *In* AGARD Combustor Modelling Feb. 1980 30 p refs (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

A system of computer programs being developed to model complex combustor flow fields is discussed. Each code solves a system of equations compatible with the type of flow being analyzed in any particular part of the combustor. For flows that remain supersonic throughout, a parabolic Navier-Stokes solver is used successfully. An extension of this computer program, to partially introduce elliptic character into the analysis by accounting for a full three dimensional pressure field, is being tested. This partially elliptic scheme accounts for the effects of streamwise pressure feedback present in the subsonic flow, thereby allowing the detection and calculation of embedded subsonic regions known to be present in the combustor. Although the partially elliptic procedure can handle mixed subsonic-supersonic flows, it still requires that a predominant flow direction exists; for recirculating flows, the fully elliptic Navier-Stokes equations are required. Since recirculating flow does exist in regions near points of fuel injection from struts in the engine, work is currently underway to begin development of a three dimensional elliptic Navier-Stokes solver. Initial work includes development of a two dimensional elliptic code for the analysis of slot fuel injectors. E.D.K.

N80-27380# International Flame Research Foundation, Ijmuiden (Netherlands).

DEVELOPMENT AND VERIFICATION OF RADIATION MODELS

H. Bartelds (Organization for Applied Scientific Research, TNO, Apeldoorn, Netherlands) *In* AGARD Combustor Modelling Feb. 1980 20 p refs (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

The prediction of radiative heat transfer from a flame may be divided into three categories: (1) the evaluation of temperature distribution and radiating species concentrations; (2) the evaluation of the absorption, emission, and scattering characteristics of the species at the prevailing temperatures; and (3) the evaluation of the radiation exchange. All three categories are discussed with respect to experiments and mathematical models. Emphasis is placed on models falling into categories two and three. The models were verified by comparison with measured radiation intensities and measured radiative heat fluxes from relatively large gas flames. Measured temperatures and species concentrations were used as input to the models. However, the models are well suited to be combined with each other and with prediction procedures for fluid flow and combustion. E.D.K.

N80-27381# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.

ASSESSMENT OF AN APPROACH TO THE CALCULATION OF THE FLOW PROPERTIES OF SPRAY-FLAMES

Y. El Banhawy and J. H. Whitelaw *In* AGARD Combustor Modelling Feb. 1980 11 p refs Sponsored by the Minister of Defence (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

A method for the calculation of the local properties of spray flames is described and its capabilities and limitations appraised by comparing calculated results with measurements. The method solves elliptic differential equations representing the conservation of mass, momentum, enthalpy, and species concentrations in finite difference form. In addition, Lagrangian equations for the droplet motion and thermal balance are solved for the finite ranges of droplet size. A two equation turbulence model, a combustion model based on mean mass fraction equations for fuel and oxidant, and a four flux radiation model are used. The droplet model assumes that the evaporating droplets act as distributed point sources of fuel vapor. The merits of the method are quantified by comparison with measurements obtained for three different spray flame geometries. The assumption of representing the spray by a finite number of size ranges was also examined and the results indicate that the importance of this number is related to the spray type and the aerodynamic features of the flow close to the spray. E.D.K.

N80-27382# Science Applications, Inc., Woodland Hills, Calif. Combustion Dynamics and Propulsion Technology Div.

FUNDAMENTAL CHARACTERIZATION OF ALTERNATIVE FUEL EFFECTS IN CONTINUOUS COMBUSTION SYSTEMS

R. B. Edelman, A. Turan, P. T. Harsha, E. Wong, and W. S. Blazowski (Exxon Research and Engineering Co., Linden, N.J.) *In* AGARD Combustor Modelling Feb. 1980 14 p refs (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

The problem of net soot generation which is aggravated by the reduced hydrogen content characteristic of syncrudes that have been identified as probable alternate fuel sources for use in gas turbines is addressed. The kinetics of the process are modeled using the quasi-global concept while experimental data are developed primarily from a laboratory jet stirred combustor. Results are presented showing that soot emissions can be characterized in terms of major species and that soot oxidation must be included in the prediction of net soot generation. In addition, the techniques being employed for coupling the chemical and aerodynamic processes are outlined. E.D.K.

N80-27383# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.

CHEMICAL KINETIC MODELLING FOR COMBUSTION APPLICATION

F. L. Dryer and C. K. Westbrook (California Univ., Livermore, Lawrence Livermore Lab.) *In* AGARD Combustor Modelling Feb. 1980 17 p refs (For primary document see N80-27371 18-07)

(Contracts W-7405-eng-48; EC-77-S-02-4272)

Avail: NTIS HC A17/MF A01

A systematic study of kinetic oxidation models for practical fuels is described. The construction of detailed reaction mechanisms for the oxidation of typical hydrocarbon fuels and the validation of these mechanisms through careful comparisons between computer and experimental data are discussed. These mechanisms are strongly hierarchical with reactions for complex fuels containing subsets which describe the combustion of chemically simpler fuels. Progress to date includes relatively complete descriptions of carbon monoxide, hydrogen, methane, and methanol oxidation. In the development and verification of these reaction mechanisms, data from a variety of experimental sources including slow reactor techniques at intermediate temperatures and shock tube results at high temperatures were used. In addition, ranges in fuel-air equivalence ratio between very lean through stoichiometric to very rich were also considered. E.D.K.

N80-27384# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering and Applied Mechanics.

COALESCENCE/DISPERSION MODELLING OF GAS TURBINE COMBUSTORS

David T. Pratt *In* AGARD Combustor Modelling Feb. 1980 13 p refs Presented at the Proj. SQUID Workshop on Gas Turbine Combust., Princeton, N.J., 31 May - 1 Jun. 1978 Sponsored in part by Utah Univ. and AVCO-Lycoming Corp. (For primary document see N80-27371 18-07)

(Grant NSF ENG-76-84533)

Avail: NTIS HC A17/MF A01

Finite rate micromixing may be introduced into both the perfectly stirred reactor (PSR) and plug flow reactor (PFR) models due to recent advances in computation of stochastic or Monte Carlo methods together with improved algorithms for calculating equilibrium and nonequilibrium chemistry. In the PSR this improvement allows assessment of the effects of primary zone inhomogeneities due to fuel-air ratio, temperature, and age or degree of reactadness within fluid elements. In the PFR regions finite rate mixing of secondary air admission into the post primary stream may be described, leading eventually to prediction of mixing inhomogeneities on pattern factors. E.D.K.

N80-27385# Office National d'Etudes et de Recherches Aerospatiques, Paris (France).

COMBUSTION ZONE MODELING IN UNSTEADY REGIME

Francis Hirsinger and Helene Tichtinsky *In* AGARD Combustor Modeling Feb. 1980 12 p refs In FRENCH; ENGLISH summary (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

A modeling of the flows was undertaken reveal characteristic behaviors rather than to represent the whole set of phenomena taking place in actual, geometrically complicated combustion zones. The modeling technique consists of writing the equations of unsteady aerothermochemical budgets, taking into account the gas dynamics of the laminar or turbulent diffusion and the chemical kinetics for a series of cells representing the domain under study. These budget equations are treated in an integral manner in: space and a differential manner in time. This method makes it possible to exactly follow the actual unsteady phenomena or to have a faster access to steady regimes through virtual unsteady evolutions. The applications presented correspond to a two dimensional flow in a duct partially choked by a plate representing a flame holder and to a three dimensional flow in a domain representing a section of flame tube fed by lateral orifices. This method permits the simulation of the establishment of the cold flow from rest, then an ignition initiated in a small zone at high temperature and the resulting oscillations, as well as the onset of a permanent flame. E.D.K.

N80-27386# California Inst. of Tech., Pasadena.

ANALYSIS OF LOW-FREQUENCY DISTURBANCES IN AFTERBURNERS

Frank E. Marble, Malladi V. Subbaiah, and Sebastien Candel, M. *In* AGARD Combustor Modelling Feb. 1980 11 p refs (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

The behavior of stabilized flame zones were examined when they were situated in an afterburner. The turbine discharge and the nozzle inlet planes were represented by appropriate admittance functions for low frequencies. The distances which separate turbine discharge, flame holders, and nozzle throat, as well as the number of flame holders, were parameters in the problem. The results show that small disturbances which originate in combustion roughness, may be amplified to serious amplitudes and the amplitude level is a strong function of the geometric parameters of the flame-afterburner arrangement. In some instances instability may result. R.E.S.

N80-27387# International Flame Research Foundation, Ijmuiden (Netherlands).

SURVEY ON PREDICTION PROCEDURES FOR THE CALCULATION OF FURNACE PERFORMANCE

J. B. Michel, S. Michelfelder, and R. Payne *In* AGARD Combustor Modelling Feb. 1980 16 p refs (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

The numerous published mathematical models for the prediction of furnace heat transfer were classified into three categories. The degree of subdivision chosen for the heat transfer calculations (dimensionality) was used as the main criterion. It is shown that the flow pattern and the desired accuracy determine the required degree of subdivision, which can be zero dimensional (model type 1), one dimensional (model type 2) or multidimensional (model type 3). The survey on models and some applications show also that all model types have their justification and their specific range of application. Models of the type 1 and 2 are generally considered to be especially suitable for practical furnace calculations and parameter studies. In principle these calculations can also be performed with models of the type 3 although their applicability is as yet confined to special cases which can be handled computationally and where the greater effort and expense is justified. For typical 3D geometries and if pollution emission data are to be predicted, which depend heavily on local properties, the use of type 3 models is indispensable. A.R.H.

N80-27388# Politecnico di Milano (Italy).

NUMERICAL ANALYSIS AND EXPERIMENTAL DATA IN A CONTINUOUS FLOW COMBUSTION CHAMBER: A COMPARISON

F. Gamma, C. Casci, A. Cogne, and U. Ghezzi *In* AGARD Combustor Modelling Feb. 1980 15 p refs (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

Measured and computed temperature distribution, axial velocity, and swirl velocity results obtained in an experimental furnace using methane as the fuel are presented and compared. The finite difference solution was obtained to the equations controlling combustion in the combustion chamber which was essentially a cylinder of inner 200 mm diameter with a test length of 1,000 mm. The fuel nozzle was placed axially in the injection head and the oxidizer was fed by two different lines. Primary air flowed through a tube surrounding the fuel nozzle, and the dilution air entered at the periphery of the injection head. In general, the agreement between theory and experiments can be considered as acceptable. A.R.H.

N80-27389# *Centre de Recherche Claude-Delorme de l'Air* Liquide, Jouy-en-Josas (France).

MODELING FURNACES FED WITH OXYGEN-ENRICHED AIR [MODELISATION DES FOURS ALIMENTES A L'AIR ENRICHI EN OXYGENE]

R. Guenot, A. Ivernel, F. C. Lockwood, and A. P. Salooja *In* AGARD Combustor Modelling Feb. 1980 12 p refs In FRENCH Prepared in cooperation with Imperial Coll. of Science and Technology, London, England (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

The numerical modeling of combustion chambers with furnaces fed with oxygenated air presents particular problems related partly to the thermal dissociation produced by high temperatures, and partly to the increased role played by radiative transfer. A model is presented for including these phenomena in existing calculations. The method is in the process of verification by means of measurements obtained on an experimental 300 kW furnace designed to operate with high intensity boilers fed by natural gas and oxygenated air or pure oxygen. The first experimental results are in good agreement with predictions made using the model. Transl. by A.R.H.

N80-27390# Technische Hogeschool, Delft (Netherlands). Thermal Power Engineering Lab.

AN EFFECTIVE PROBABILISTIC SIMULATION OF THE TURBULENT FLOW AND COMBUSTION IN AXISYMMETRIC FURNACES

Th. T. A. Paauw, A. J. Stroo, and C. W. J. Vanloppen *In* AGARD Combustor Modelling Feb. 1980 22 p refs (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

The conservation equations governing the flow field and the combustion process in isothermal and in diffusion controlled combusting confined flows are solved using a numerical finite difference technique; the results are compared with measurements. The combustion process of the hydrocarbon fuel was modeled by using instant reaction with fluctuations in the mixture fracture, and with three different assumptions for the chemical conditions: frozen chemistry, equilibrium chemistry and partial equilibrium chemistry. Attention is paid to the formation of nitrogen oxides, and it is shown that in hydrocarbon diffusion flames a substantial amount of the NO formed is due to prompt NO formation. An effective model is presented for this process. Author

N80-27391# Institut Francais du Petrole, Rueil-Malmaison.

MATHEMATICAL MODELING OF BOILER OPERATIONS

[MODELISATION MATHEMATIQUE DU FONCTIONNEMENT DES CHAUDIERES DE CHAUFFAGE]

E. Perthuis *In* AGARD Combustor Modelling Feb. 1980 24 p refs In FRENCH (For primary document see N80-27371 18-07)
Avail: NTIS HC A17/MF A01

During a cooperative study of small boilers for domestic heating, a mathematical model was developed which describes the phenomena regulating the boiler operations and studies their evolution as a function of practical parameters. The operations of a given apparatus can be simulated in continuous or discontinuous regime. The influences on the boiler of such a parameters as heat insulation, load factor, boiler control, and control of the differential of the aquastat can be estimated. The order of magnitude of heat maintenance can also be predicted, something which is difficult to determine on a test bed.
Transl. by A.R.H.

N80-27392# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).

A CHEMICAL REACTOR MODEL AND ITS APPLICATION TO A PRACTICAL COMBUSTOR

W. Krockow, B. Simon, and E. C. Parnell (Rolls-Royce Ltd., Bristol, England) *In* AGARD Combustor Modelling Feb. 1980 19 p refs Sponsored in part by Bundesministerium der Verteidigung (For primary document see N80-27371 18-07)
Avail: NTIS HC A17/MF A01

A computer model of a combustion chamber is presented, which in its approach is based on chemical reactors. The reactive flow field of the combustor primary zone is divided into elements (vortices) with different mixture ratios and residence times. The variations in concentration in each element are calculated by means of a detailed kinetic reaction mechanism, in which the decomposition of the fuel to carbon monoxide and hydrogen is described by a one-step-quasi-global reaction rate. Each element born in the primary zone of the combustor reacts according to its residence time and is subsequently followed on its way through the remaining zones of the combustor by the computer, with discrete amounts of air being added corresponding to the boundary conditions in the combustor. Idealization of the model (normal distribution) is supported by measurement of the gas concentration at the outlet from the primary zone of a vaporiser-annular combustion chamber. Comparison between the calculated primary zone and outlet concentrations of nitric oxide, CO and unburned hydrocarbons and the measurements show very good agreement.
Author

N80-27393# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.

SEMI-EMPIRICAL CORRELATIONS FOR GAS TURBINE EMISSIONS, IGNITION, AND FLAME STABILIZATION

A. M. Mellor *In* AGARD Combustor Modelling Feb. 1980 13 p refs (For primary document see N80-27371 18-07) (Contract F33615-77-C-2069)
Avail: NTIS HC A17/MF A01

For operating conditions where the fuel evaporation rate is fast compared to the fuel vapor/air mixing rate, a characteristic time model has been formulated to predict gaseous emissions and efficiency in terms of combustor inlet conditions and geometry. The model, which involves kinetic and fluid mechanic times, has been used to design low metric oxide burners, and study of several different conventional engine combustors suggests that the correlation may be universal. A related model, which includes a fuel droplet evaporation time, is being validated with data from laboratory combustors for spark ignition and lean flame stabilization. The preliminary application of this latter model to engine situations is described.
Author

N80-27394# Universite Laval (Quebec).

COMBUSTION MODELLING WITHIN GAS TURBINE ENGINES, SOME APPLICATIONS AND LIMITATIONS

J. Odgers *In* AGARD Combustor Modelling Feb. 1980 14 p refs (For primary document see N80-27371 18-07)
Avail: NTIS HC A17/MF A01

Some of the more pertinent models postulated to describe the performance of gas turbine combustors are reviewed. Six different design/development stages are considered: (1) the initial sizing of a combustor; (2) the initial development testing; (3) primary zone modelling; (4) secondary zone modelling; (5) dilution zone modelling; and (6) changes due to the alteration of ambient conditions. The models are assessed in scope 1 plausibility, experimentally, and in terms of time and economic justification. For (1) it is suggested that a zero-dimensional model suffice, as also for (2). Item (3) will probably require a three dimensional model; (4) and (5) with probably suffice with A zone or two dimensional model. For item (6) a zero-order model might well be satisfactory. If it can be produced with sufficient accuracy, a single complex (probably three dimensional) model could adequately describe all items, (1) to (6). The need of future data, the type of models which may be used currently, and those which are likely to be used in the future are discussed.
A.R.H.

N80-27395# Office National d'Etudes et de Recherches Aeronautiques, Paris (France).

AERODYNAMIC STUDY OF A COMBUSTION CHAMBER WITH A VIEW TO ITS SEMI-EMPIRICAL MODELLING

Patrick Hebrard and Philippe Magre *In* AGARD Combustor Modelling Feb. 1980 18 p refs In FRENCH; ENGLISH summary (For primary document see N80-27371 18-07)
Avail: NTIS HC A17/MF A01

The prediction of combustion performance and of polluting species formation in turbomachine combustors requires a calculation method that takes into account all phenomena taking place in various parts of the combustion chamber. Among these, aerodynamic effects, often very poorly known, must be introduced to justify modelling methods based on a combination of elementary combustors; these methods rest on a correct description of their features and their relationships: location, nature, volume, flowrate and distribution, connexions. To this end, experiments were carried out on a combustor model, both without and with combustion, with a view to: (1) characterize the combustor aerodynamics, by visualizations in the water tunnel and velocity measurements on an aerodynamic model; (2) measure residence times in a flame tube by thermodilution (aerodynamics) and particle dynamics (water tunnel); and (3) determine the combustion efficiency and the polluting species production for each regime. Using these results for the development of a one dimensional model of elementary combustors makes it possible to calculate the distribution function of residence time in all elmentary reactors, especially in the primary zone. The overall performance of the combustor can also be predicted. The agreement between calculated and experimental results is satisfactory if the simplicity of the assumptions on which the model is based is considered.
A.R.H.

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-27396 California Univ., Berkeley.

COUPLED BENDING-TORSION FLUTTER IN CASCADES WITH APPLICATIONS TO FAN AND COMPRESSOR BLADES Ph.D. Thesis

Oddvar Olav Bendiksen 1980 270 p
Avail: Univ. Microfilms Order No. 8015952

A method is presented for determining the aeroelastic stability boundaries of a cascade with aerodynamic, inertial, and structural coupling between the bending and torsional degrees of freedom. The real rotor is modeled as an infinite two dimensional cascade of identical harmonic motion, with an arbitrary but constant interblade phase angle. Lane's assumption about the possible flutter mode shapes is assumed to hold. Two different unsteady aerodynamic theories are incorporated into the flutter analysis. The first is Whitehead's solution for the unsteady incompressible flow through an oscillating cascade. The second is a solution for the unsteady supersonic flow through a cascade with a subsonic leading edge locus. The aeroelastic stability boundary of the cascade is obtained by solving a complex eigenvalue problem, analogous to the isolated wing case. The eigenvalue problem is solved directly, and the critical interblade phase angle is determined by minimizing the flutter speed with respect to this

phase angle, while maintaining the restrictions imposed by Lane's assumption. Boundaries are presented for both the incompressible and the supersonic case, for several cascade configurations, locations of elastic axis, coupling strength, and structural damping. Dissert. Abstr.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see *also 14 Ground Support Systems and Facilities (Space).*

N80-27397*# Northrop Corp., Hawthorne, Calif. Aerosciences Lab.

SYSTEM DESCRIPTION AND ANALYSIS. PART 1: FEASIBILITY STUDY FOR HELICOPTER/VTOL WIDE-ANGLE SIMULATION IMAGE GENERATION DISPLAY SYSTEM Final Report

Oct. 1977 198 p Sponsored in part by Army Air Mobility and Research and Development Lab. and Ames Research Center, Mountain View, Calif.

(Contract NAS2-9351)

(NASA-CR-152376; NOR-77-102-Pt-1) Avail: NTIS HC A09/MF A01 CSCL 14B

A preliminary design for a helicopter/VSTOL wide angle simulator image generation display system is studied. The visual system is to become part of a simulator capability to support Army aviation systems research and development within the near term. As required for the Army to simulate a wide range of aircraft characteristics, versatility and ease of changing cockpit configurations were primary considerations of the study. Due to the Army's interest in low altitude flight and descents into and landing in constrained areas, particular emphasis is given to wide field of view, resolution, brightness, contrast, and color. The visual display study includes a preliminary design, demonstrated feasibility of advanced concepts, and a plan for subsequent detail design and development. Analysis and tradeoff considerations for various visual system elements are outlined and discussed. E.D.K.

N80-27398# Operations Research, Inc., Silver Spring, Md.

STUDY OF OPTICAL TECHNIQUES FOR INDIRECT GENERATION OF RUNWAY APPROACH LIGHTS Final Report, Sep. 1978 - Sep. 1979

James C. Bremer, L. James Happel, and Ronald A. Parise Sep. 1979 55 p refs

(AD-A080434; ORI-TR-1557) Avail: NTIS HC A04/MF A01 CSCL 01/5

The steel towers which are currently used to support runway approach lights present a significant collision hazard to landing aircraft, and are being replaced by frangible towers which reduce, but do not eliminate, this hazard. This study analyzes optical concepts for indirect generation of runway approach lights which would reduce the tower height or the mass of elevated components. Three concepts are investigated: projection of images with mirrors, use of a ground based lamp in conjunction with a diverging mirror in the light plane, and use of a fiber optic light pipe. The projection of images can achieve a height reduction of several feet, but would require the construction and maintenance of large mirrors. The other two techniques could eliminate wiring from elevated structures, but would require more complex optics and higher levels of power consumption. None of these techniques appears to be practical when the marginal benefits are weighted against their complexity and cost. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N80-27399*# General Dynamics/Convair, San Diego, Calif.

SPACE CONSTRUCTION AUTOMATED FABRICATION EXPERIMENT DEFINITION STUDY (SCAFEDS), PART 3, VOLUME 3: REQUIREMENTS Final Report

29 Jun. 1979 115 p refs

(Contract NAS9-15310)

(NASA-CR-160747; CASD-ASP78-016-Pt-3-Vol-3) Avail: NTIS HC A06/MF A01 CSCL 22A

The performance, design and verification requirements for the space Construction Automated Fabrication Experiment (SCAFE) are defined. The SCAFE program defines, develops, and demonstrates the techniques, processes, and equipment required for the automatic fabrication of structural elements in space and for the assembly of such elements into a large, lightweight structure. The program defines a large structural platform to be constructed in orbit using the space shuttle as a launch vehicle and construction base. E.D.K.

N80-27400*# Rockwell International Corp., Downey, Calif. Satellite Systems Div.

SPACE CONSTRUCTION SYSTEM ANALYSIS STUDY: PROJECT SYSTEMS AND MISSIONS DESCRIPTIONS Final Report

26 Apr. 1979 301 p refs

(Contract NAS9-15718)

(NASA-CR-160748; SSD-79-0077) Avail: NTIS HC A14/MF A01 CSCL 22A

Three project systems are defined and summarized. The systems are: (1) a Solar Power Satellite (SPS) Development Flight Test Vehicle configured for fabrication and compatible with solar electric propulsion orbit transfer; (2) an Advanced Communications Platform configured for space fabrication and compatible with low thrust chemical orbit transfer propulsion; and (3) the same Platform, configured to be space erectable but still compatible with low thrust chemical orbit transfer propulsion. These project systems are intended to serve as configuration models for use in detailed analyses of space construction techniques and processes. They represent feasible concepts for real projects; real in the sense that they are realistic contenders on the list of candidate missions currently projected for the national space program. Thus, they represent reasonable configurations upon which to base early studies of alternative space construction processes. E.D.K.

N80-27401# National Aeronautical Lab., Bangalore (India). Materials Science Div.

PROCESSING OF MATERIALS IN SPACE

S. Ramaseshan Jul. 1978 18 p refs

(ISRO-SN-04-78) Avail: NTIS HC A02/MF A01

The generation of convection flow by gravity and surface tension forces is examined and the advantages of weightlessness processing for materials are discussed with particular attention on electrophoresis, liquid phase miscibility gap, eutectic alloys, crystal growth, and magnetic materials. The use of a molecular shield for producing ultrahigh vacuum over a large volume at an altitude of 200 to 300 km is described. Opportunities provided by space shuttle for spaceborne experiments in these areas are summarized and possible Indian Space program experiments are mentioned. A.R.H.

N80-27402*# National Aeronautics and Space Administration, Washington, D. C.

PROBLEMS AND STRATEGY OF THE FIRST FLIGHT TO THE COMETS

V. D. Davydov Jun. 1980 25 p refs Transl. into ENGLISH "Problemy i Strategiya Pervogo Poleta k Komete", rept. Pr-399 Acad. of Sci. USSR Inst. of Space Res., Moscow, 1978 p 1-25 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-76241; PR-399) Avail: NTIS HC A02/MF A01 CSCL 22A

Substantiation is given for the urgency of using space equipment to study comets in order to work out the basic problem of the origin and evolution of the solar system. The potentialities and advantages of selecting ballistically-accessible objects among the newly discovered comets are shown (as a preliminary study).

The technique of early detection of such objects is discussed.
Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-27403*# General Dynamics/Convair, San Diego, Calif.
CONCEPTUAL DESIGN OF TWO-PHASE FLUID MECHANICS AND HEAT TRANSFER FACILITY FOR SPACELAB
B. F. North and M. E. Hill Jun. 1980 190 p refs
(Contract NAS3-21750)
(NASA-CR-159810; GDC-CRAD-80-002) Avail: NTIS HC A09/MF A01 CSCL 14B

Five specific experiments were analyzed to provide definition of experiments designed to evaluate two phase fluid behavior in low gravity. The conceptual design represents a fluid mechanics and heat transfer facility for a double rack in Spacelab. The five experiments are two phase flow patterns and pressure drop, flow boiling, liquid reorientation, and interface bubble dynamics. Hardware was sized, instrumentation and data recording requirements defined, and the five experiments were installed as an integrated experimental package. Applicable available hardware was selected in the experiment design and total experiment program costs were defined. Author

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-27404# Department of Energy, Washington, D. C. Office of Energy Research.
SATELLITE POWER SYSTEMS (SPS): CONCEPT DEVELOPMENT AND EVALUATION PROGRAM, PRELIMINARY ASSESSMENT
Sep. 1979 21 p refs
(DOE/ER-0041) Avail: NTIS HC A02/MF A01

Preliminary results of a DOE-NASA 3-year study of satellite solar energy conversion and microwave transmission to Earth are presented. The assessment includes technical and economic feasibility; the effects of the microwave power transmission beam on biological, ecological, and electromagnetic systems; the impact of SPS construction, deployment and operations on the biosphere and on society; and the merits of SPS compared to other future energy alternatives. DOE

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N80-27405*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE PROGRAM. STS-7 CONCEPTUAL FLIGHT PROFILE. IUS/TDRS-A
Jun. 1979 110 p Supersedes JSC-13968
(NASA-TM-81090; JSC-15045; JSC-13968; Rept-79-FM-22) Avail: NTIS HC A06/MF A01 CSCL 22A

The Space Transportation System (STS) Flight Assignment Manifest has has scheduled a Tracking and Data Relay Satellite System (TDRSS) spacecraft for a February 1981 launch on STS Flight 7. The preliminary flight profile that conceptually implements the flight requirements and constraints levied by the STS, inertial upper stage (IUS), and the TDRS spacecraft is presented. The integrated major flight design guidelines and requirements used in the development of the flight profile are included together with a flight sequence of events and time line that describe the profile and reflect implementation of the integrated set of requirements. L.F.M.

N80-27406*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE PROGRAM. STS-7 FEASIBILITY ASSESSMENT: IUS/TDRS-A
Jul. 1979 63 p refs Supersedes JSC-14235
(NASA-TM-81091; JSC-16026; JSC-14235; Rept-79-FM-23) Avail: NTIS HC A04/MF A01 CSCL 22A

This Space Transportation System 7 (STS-7) Flight Feasibility Assessment (FFA) provides a base from which the various design, operation, and integration elements associated with Tracking and Data Relay Satellite-A can perform mission planning and analysis. The STS-7 FFA identifies conflicts, issues, and concerns associated with the integrated flight design requirements and constraints. E.D.K.

N80-27407*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE PROGRAM. ONORBIT NAVIGATION INTEGRATOR RESULTS FOR TYPICAL SHUTTLE ORBITS
Oscar W. Olszewski Jul. 1979 40 p refs
(NASA-TM-81092; JSC-16011; Rept-79-FM-25) Avail: NTIS HC A03/MF A01 CSCL 22A

Three types of navigation onorbit numerical integrators were evaluated: (1) power integrators with no delta-V incorporation, just coasting (using Taylor series expansion integrators); (2) coasting integrators using the Cowell method of special perturbations; and (3) coasting integrator using the Pines variation of parameter perturbation method. Results show that the super G integrator is a very simple and effective for 2 and 4 second time steps. Since IMU delta-V data can be easily incorporated in the integration scheme, its use as the standard onorbit navigation propagator for the maintenance of the current state was implemented in the onboard navigation software. The Pines formulation method with a Runge-Kutta-Gill fourth-order integrator method produces excellent results up to 300 second time steps. On orbit prediction with this method was implemented in the onboard onorbit navigation scheme. The Runge-Kutta third order, using Cowell's method, is an excellent general purpose determination integrator for time steps up to a 60 second duration. A.R.H.

N80-27408*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE PROGRAM. MCC LEVEL C FORMULATION REQUIREMENTS: ENTRY GUIDANCE AND ENTRY AUTOPILOT
Jon C. Harpold and Oliver Hill Jan. 1980 118 p refs
(NASA-TM-81093; JSC-11746; Rept-76-FM-98) Avail: NTIS HC A06/MF A01 CSCL 22A

A set of preliminary entry guidance and autopilot software formulations is presented for use in the Mission Control Center (MCC) entry processor. These software formulations meet all

level B requirements. Revision 2 incorporates the modifications required to functionally simulate optimal TAEM targeting capability (OTT). Implementation of this logic in the MCC must be coordinated with flight software OTT implementation and MCC TAEM guidance OTT. The entry guidance logic is based on the Orbiter avionics entry guidance software. This MCC requirements document contains a definition of coordinate systems, a list of parameter definitions for the software formulations, a description of the entry guidance detailed formulation requirements, a description of the detailed autopilot formulation requirements, a description of the targeting routine, and a set of formulation flow charts. A.R.H.

N80-27409*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE PROGRAM. MCC LEVEL C FORMULATION REQUIREMENTS: SHUTTLE TAEM GUIDANCE AND FLIGHT CONTROL
Gilbert L. Carman Jan. 1980 86 p Revised
(NASA-TM-81094; JSC-11786-Rev-2; Rept-76-FM-87-Rev-2) Avail: NTIS HC A05/MF A01 CSCL 22A

The Level C requirements for the shuttle orbiter terminal area energy management (TAEM) guidance and flight control functions to be incorporated into the Mission Control Center entry profile planning processor are defined. This processor will be used for preentry evaluation of the entry through landing maneuvers, and will include a simplified three degree-of-freedom model of the body rotational dynamics that is necessary to account for the effects of attitude response on the trajectory dynamics. This simulation terminates at TAEM-autoland interface. A.R.H.

N80-27410*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE PROGRAM: OFT ASCENT/DESCENT ANCILLARY DATA REQUIREMENTS DOCUMENT
A. C. Bond, Jr. and J. Knoedler Feb. 1980 58 p ref Revised
(NASA-TM-81095; JSC-14C-14370-Rev-1; Rept-78-FM-40-Rev-1) Avail: NTIS HC A04/MF A01 CSCL 22A

Requirements are presented for the ascent/descent (A/D) navigation and attitude-dependent ancillary data products to be generated for the space shuttle orbiter in support of the orbital flight test (OFT) flight test requirements, MPAD guidance and navigation performance assessment, and the mission evaluation team. The A/D ancillary data support for OFT mission evaluation activities is confined to providing postflight position, velocity, attitude, and associated navigation and attitude derived parameters for the Orbiter over particular flight phases and time intervals. A.R.H.

N80-27411*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
STS-1 OPERATIONAL FLIGHT PROFILE. VOLUME 3: ASCENT, CYCLE 3
May 1980 300 p refs Revised
(NASA-TM-81096; JSC-14483-Vol-3-Rev-1; Rept-78-FM-51-Vol-3-Rev-1) Avail: NTIS HC A13/MF A01 CSCL 22A

The ascent operational flight profile for the space transportation system 1 flight is designed (1) to limit the maximum undispersed dynamic pressure to 580 lb/sq ft, (2) to follow the design load indicator profiles where q alpha is a specified profile and q beta is desired to be as close to zero as possible, and (3) to maximize nominal and abort performance. Significant trajectory parameters achieved are presented. A maximum dynamic pressure of 575 lb/sq ft was achieved, a minimum q alpha of -2187 lb-deg/sq ft was achieved, and q beta was limited to approximately + or - 100 lb-deg/sq ft in the high q region of the trajectory. The trajectory performance allows a press to main engine cutoff capability with one space shuttle main engine out at 262 seconds ground elapsed time. The orbital maneuvering system burns achieve a final orbit of 150.9 x 149.9 x 149.8 n. mi. and the desired inclination of 40.3 degrees. E.D.K.

N80-27412*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
STS-1 OPERATIONAL FLIGHT PROFILE. VOLUME 5: DESCENT, CYCLE 3. APPENDIX C: MONTE CARLO DISPERSION ANALYSIS
Jun. 1980 336 p refs Revised
(NASA-TM-81097; JSC-14483-Vol-5-Rev-1-App-C; Rept-78-FM-51-Vol-5-R-1-App-C) Avail: NTIS HC A15/MF A01 CSCL 22A

The results of three nonlinear the Monte Carlo dispersion analyses for the Space Transportation System 1 Flight (STS-1) Orbiter Descent Operational Flight Profile, Cycle 3 are presented. Fifty randomly selected simulation for the end of mission (EOM) descent, the abort once around (AOA) descent targeted line are steep target line, and the AOA descent targeted to the shallow target line are analyzed. These analyses compare the flight environment with system and operational constraints on the flight environment and in some cases use simplified system models as an aid in assessing the STS-1 descent flight profile. In addition, descent flight envelops are provided as a data base for use by system specialists to determine the flight readiness for STS-1. The results of these dispersion analyses supersede results of the dispersion analysis previously documented. E.D.K.

N80-27413*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
STS-1 OPERATIONAL FLIGHT PROFILE. VOLUME 6: ABORT ANALYSIS
Jun. 1980 624 p refs Revised
(NASA-TM-81098; JSC-14483-Vol-6-Rev-1; Rept-78-FM-51-Vol-6-Rev-1) Avail: NTIS HC A99/MF A01 CSCL 22A

The abort analysis for the cycle 3 Operational Flight Profile (OFP) for the Space Transportation System 1 Flight (STS-1) is defined, superseding the abort analysis previously presented. Included are the flight description, abort analysis summary, flight design groundrules and constraints, initialization information, general abort description and results, abort solid rocket booster and external tank separation and disposal results, abort monitoring displays and discussion on both ground and onboard trajectory monitoring, abort initialization load summary for the onboard computer, list of the key abort powered flight dispersion analysis. E.D.K.

N80-27414*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ORBITER S-BAND DIRECT LINK SYSTEM VERIFICATION TEST REPORT
B. K. Vermillion May 1980 141 p refs
(NASA-TM-81110; JSC-16680) Avail: NTIS HC A07/MF A01 CSCL 22B

Space-to-ground S-band communications system compatibility and performance tests were performed for the various radio frequency links. These tests consisted of the various uplink and downlink signal combinations (data rates) for the phase modulation system and both realtime and playback data rates for the frequency modulated downlink systems. In addition, tests involving encryption/decryption, Doppler, and acquisition were performed. Results show that the S-band transponder for the space shuttle orbiter is compatible with the S-band equipment of the AFSCF/RTS (Air Force Satellite Control Facility/Remote Tracking Station). It is also concluded that the performance of the orbiter-AFSCF/RTS direct link exceeds the required performance and that this communications link will meet the system requirements of the Space Transportation System. L.F.M.

N80-27415*# Remtech, Inc., Huntsville, Ala.
SPACE SHUTTLE MAIN ENGINE PLUME RADIATION MODEL
John E. Reardon and Young C. Lee Dec. 1978 196 p refs (Contract NAS8-29270)
(NASA-CR-161498; RTR-014-7) Avail: NTIS HC A09/MF A01 CSCL 21H

The methods are described which are used in predicting the thermal radiation received by space shuttles, from the plumes of the main engines. Radiation to representative surface locations were predicted using the NASA gaseous plume radiation GASRAD program. The plume model is used with the radiative view factor (RAVFAC) program to predict sea level radiation at specified

body points. The GASRAD program is described along with the predictions. The RAVFAC model is also discussed. F.O.S.

N80-27416*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
RETRIEVAL TECHNIQUES: LVLH AND INERTIALLY STABILIZED PAYLOADS
J. A. Yglesias May 1980 42 p
(NASA-TM-81099; JSC-16425; Rept-80-FM-12) Avail: NTIS HC A03/MF A01 CSCL 22B

Procedures and techniques are discussed for retrieving payloads that are inertially or local vertical/local horizontal (LVLH) stabilized. Selection of the retrieval profile to be used depends on several factors: (1) control authority of the payload, (2) payload sensitivity to primary reaction control system (PRCS) plumes, (3) whether the payload is inertially or LVLH stabilized, (4) location of the grapple fixture, and (5) orbiter propellant consumption. The general retrieval profiles recommended are a V-bar approach for payloads that are LVLH or gravity-gradient stabilized, and the V-bar approach with one or two phase flyaround for inertially stabilized payloads. Once the general type of profile has been selected, the detailed retrieval profile and timeline should consider the various guidelines, groundrules, and constraints associated with a particular payload or flight. Reaction control system (RCS) propellant requirements for the recommended profiles range from 200 to 1500 pounds, depending on such factors as braking techniques, flyaround maneuvers (if necessary), and stationkeeping operations. The time required to perform a retrieval (starting from 1000 feet) varies from 20 to 130 minutes, depending on the complexity of the profile. The goals of this project are to develop a profile which ensures mission success; to make the retrieval profiles simple; and to keep the pilot workload to a minimum by making use of the automatic features of the orbiter flight software whenever possible. F.O.S.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-27417 Cornell Univ., Ithaca, N. Y.
AN ATTITUDE ACQUISITION TECHNIQUE FOR DUAL-SPIN SPACECRAFT Ph.D. Thesis
Carl Henry Hubert 1980 125 p
Avail: Univ. Microfilms Order No. 8015681

Alignment of the spacecraft rotor axis with the angular momentum vector is achieved by spinning up the rotor, and then allowing passive energy dissipation mechanisms to act while the rotor is made to spin at a constant rate relative to the remainder of the spacecraft. If the rotor spin rate is correct, the desired state will be asymptotically stable, no other stable state will exist, and the alignment will be achieved. The validity of this technique is demonstrated by an energy analysis, illustrated by a geometrical technique, and confirmed by the results of computer simulations. It is demonstrated that, with the proper choice of rotor speed, the initial conditions and dynamic history of the spacecraft during rotor spin up are irrelevant to the ultimate convergence of the rotor axis to the desired orientation. Because of this, a number of maneuvers previously thought to be impossible are now known to be feasible. Dissert. Abstr.

N80-27418*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SHAPE CHANGE OF GALILEO PROBE MODELS IN FREE-FLIGHT TESTS
Chul Park and Charles F. Derose Jun. 1980 41 p refs
(NASA-TM-81209; A-8223) Avail: NTIS HC A03/MF A01 CSCL 22B

Scale models of the Galileo Probe made of polycarbonate, AXF5Q graphite, carbon-carbon composite, and carbon-phenolic were flown in a free flight range in an ambient gas of air, krypton, or xenon. Mach numbers varied between 14 and 24, Reynolds numbers between 300,000 and 1,000,000, stagnation pressures between 31 and 200 atm, and stagnation point heat transfer rates between 10 and 1,000 kW/sq cm. Shadowgraphs indicate gouging ablation of the aft portion of the frustum; the gouging was moderate in air and severe in the noble gases. The graphite models break in the same region. An explanation of the phenomena is offered in terms of the strong compression and shear caused by the reattachment of a turbulent separated flow. Conditions are calculated for similar tests appropriate for Von Karman Facility of the Arnold Engineering Development Center in which a larger model can be flown in argon. Author

N80-27419*# Howard Univ., Washington, D. C. School of Engineering.
THE DYNAMICS AND CONTROL OF LARGE FLEXIBLE SPACE STRUCTURES, 3. PART A: SHAPE AND ORIENTATION CONTROL OF A PLATFORM IN ORBIT USING POINT ACTUATORS Final Report
Peter M. Bainum, A. S. S. R. Reddy, R. Krishna, and Paul K. James Jun. 1980 179 p refs
(Grant NsG-1414)
(NASA-CR-163253) Avail: NTIS HC A09/MF A01 CSCL 22B

The dynamics, attitude, and shape control of a large thin flexible square platform in orbit are studied. Attitude and shape control are assumed to result from actuators placed perpendicular to the main surface and one edge and their effect on the rigid body and elastic modes is modelled to first order. The equations of motion are linearized about three different nominal orientations: (1) the platform following the local vertical with its major surface perpendicular to the orbital plane; (2) the platform following the local horizontal with its major surface normal to the local vertical; and (3) the platform following the local vertical with its major surface perpendicular to the orbit normal. The stability of the uncontrolled system is investigated analytically. Once controllability is established for a set of actuator locations, control law development is based on decoupling, pole placement, and linear optimal control theory. Frequencies and elastic modal shape functions are obtained using a finite element computer algorithm, two different approximate analytical methods, and the results of the three methods compared. Author

N80-27420# TRW Defense and Space Systems Group, Redondo Beach, Calif.
COST/BENEFIT ANALYSIS OF REENTRY VEHICLE HARDNESS TESTING USING THE FAST METHODOLOGY. VOLUME 2: METHODS Final Report, 23 Jan. 1978 - 30 Mar. 1979
L. H. Donahue 30 Mar. 1979 64 p refs
(Contract DNA001-78-C-0135)
(AD-A083336; AD-E300739; TRW-33030-6003-RU-81-Vol-2; DNA-4949F-2) Avail: NTIS HC A04/MF A01 CSCL 16/3

The Failure Analysis by Statistical Techniques (FAST) methodology was extended to provide new techniques for estimating the potential benefits of testing under uncertainty. A new computer code named ELF, Evaluation of Likelihood Function, was developed to provide a thorough evaluation of test results. Two demonstrate the ELF Code, this code was used to analyze magnetic flyer plate data on graphite resin material samples. The development of the statistical and analytical techniques that

were incorporated into the ELF code is described in detail. Also reported is a version of the FAST code, FAST7, Conditional Probability FAST, which shows great promise for test planning and evaluation analysis. J.M.S.

19 SPACECRAFT INSTRUMENTATION

For related information see also 06 Aircraft Instrumentation and 35 Instrumentation and Photography.

N80-27421*# Stanford Univ., Calif.
[RESULTS OF AN ISEE-1 EXPERIMENT TO STUDY THE INTERACTIONS BETWEEN ENERGETIC PARTICLES AND DISCRETE VLF WAVES IN THE MAGNETOSPHERE] Final Report
Apr. 1980 241 p
(Contract NAS5-20871)
(NASA-CR-160006) Avail: NTIS HC A11/MF A01 CSCL 14B

Despite the malfunctioning of the digital portion of the experiment which is encoding the absolute amplitude of the wave spectrum with a fixed bias of approximately 20 dB, the analog portion of the instrument is acquiring excellent data concerning the wave function and relative amplitude. Results obtained over a 2-year period which have important implications for magnetospheric wave-particle interactions are examined in the areas of emission generation by nonconducted coherent waves, and cold plasma distribution in the inner magnetosphere. A.R.H.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also 07 Aircraft Propulsion, 28 Propellants and Fuels, and 44 Energy Production and Conversion.

N80-27422 Washington State Univ., Pullman.
THE FATE AND BEHAVIOR OF FUEL-SULFUR IN COMBUSTION SYSTEMS Ph.D. Thesis
John Charles Kramlich 1980 225 p
Avail: Univ. Microfilms Order No. 8015151

The behavior of sulfur during the combustion of methane, propane, acetylene, hydrogen, and a mixture of hydrogen and carbon was studied in a modified Longwell jet-stirred reactor operating at 0.92 atmospheres. Sulfur dioxide was shown to represent the majority of the flame sulfur and the sulfur behavior observed was, to first order, independent or sulfur additive type. The results for the hydrogen flame were consistent with the assumption that the sulfur species were mutually equilibrated within the non-equilibrium flame. A partial equilibrium model predicted that, after SO2, SO was the most important flame species. A chemical kinetic probe model was applied to the modeled combustion gases which resulted in the reduction of sampled SO into H2S within the probe at fuel-rich conditions; at fuel-lean conditions, SO was oxidized into SO2. The results for the hydrocarbon flames indicated that the measured H2S, COS, and CS2 were probe formed from sulfur in the reactive intermediates SO, CS,S and SH. Dissert. Abstr.

N80-27423*# Remtech, Inc., Huntsville, Ala.
A COMPUTER PROGRAM FOR THERMAL RADIATION FROM GASEOUS ROCKET EXHUAST PLUMES (GASRAD)
John E. Reardon and Young C. Lee Dec. 1979 183 p refs
(Contract NAS8-29270)
(NASA-CR-161496; RTR-014-9) Avail: NTIS HC A09/MF A01 CSCL 21H

A computer code is presented for predicting incident thermal radiation from defined plume gas properties in either axisymmetric or cylindrical coordinate systems. The radiation model is a statistical band model for exponential line strength distribution with Lorentz/Doppler line shapes for 5 gaseous species (H2O, CO2, CO, HCl and HF) and an appoximate (non-scattering) treatment of carbon particles. The Curtis-Godson approximation is used for inhomogeneous gases, but a subroutine is available for using Young's intuitive derivative method for H2O with Lorentz line shape and exponentially-tailed-inverse line strength distribution. The geometry model provides integration over a hemisphere with up to 6 individually oriented identical axisymmetric plumes, a single 3-D plume. Shading surfaces may be used in any of 7 shapes, and a conical limit may be defined for the plume to set individual line-of-sight limits. Intermediate coordinate systems may specified to simplify input of plumes and shading surfaces.
Author

N80-27424*# Xerox Electro-Optical Systems, Pasadena, Calif.
INERT GAS ION THRUSTER DEVELOPMENT Interim Report, Apr. 1978 - Feb. 1979
William D. Ramsey Mar. 1980 99 p refs
(Contract NAS3-21345)
(NASA-CR-159805; XEOS-2372; IR-1) Avail: NTIS HC A05/MF A01 CSCL 21C

Two 12 cm magneto-electrostatic containment (MESC) ion thrusters were performance mapped with argon and xenon. The first, hexagonal, thruster produced optimized performance of 48.5 to 79 percent argon mass utilization efficiencies at discharge energies of 240 to 425 eV/ion, respectively. Xenon mass utilization efficiencies of 78 to 95 percent were observed at discharge energies of 220 to 290 eV/ion with the same optimized hexagonal thruster. Changes to the cathode baffle reduced the discharge anode potential during xenon operation from approximately 40 volts to about 30 volts. Preliminary tests conducted with the second, hemispherical, MESC thruster showed a nonuniform anode magnetic field adversely affected thruster performance. This performance degradation was partially overcome by changes in the boundary anode placement. Conclusions drawn the hemispherical thruster tests gave insights into the plasma processes in the MESC discharge that will aid in the design of future thrusters. Author

N80-27425*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
ROCKET RESEARCH AT GEORGIA TECH. Interim Report, 1 Oct. 1978 - 30 Sep. 1979
E. W. Price, W. C. Strahle, Ben T. Zinn, J. E. Hubbartt, D. H. Neale, R. K. Signan, and B. R. Daniel Nov. 1979 135 p refs
(Contract F49620-78-C-0003; AF Proj. 2308)
(AD-A083764; AFOSR-80-0305TR) Avail: NTIS HC A07/MF A01 CSCL 21/8

Progress is reported on four distinct projects which are administered as a group. The individual projects are identified as tasks and reported on separately. A summary for each task follows: Task I. Work concerned improvement and application of the impedance tube method for measurement of the pressure-coupled combustion response of solid propellants and measurement of the bulk damping in the product flow. Improvements included increased sites and amplitude range of pressure measurements; increased capacity of the data acquisition system; and a modified, more rapid data reduction program. Admittances and bulk loss coefficients of nonaluminized and aluminized propellants were measured over a range of frequencies. Task 2. Studies were continued on external burning using an axisymmetric model at Mach 3. Tests with actual combustion of radially and axially injected hydrogen are then reported. Outstanding performance values with significant base drag reduction is shown for injection and burning directly in the near-wake (base burning). Task 3. Investigations continued on the accumulation processes of aluminum on the propellant burning surface that lead to formation of agglomerate droplets, the size of which dominates aluminum combustion. Task 4. Experimental and analytical studies were continued on the subject of turbulence-induced pressure fluctuations in a rocket-like cavity. A new theory was constructed for the generation of pressure disturbances by the turbulence. Undeniable separation has been achieved between propagational and local pressure fluctuations, and the agreement is adequate.
GRA

N80-27426# Aerospace Corp., El Segundo, Calif.
MULTICOLOR INVERSION DIAGNOSTIC FOR TACTICAL MOTOR PLUMES Interim Report
Stephen J. Young May 1980 93 p
(Contract F04701-79-C-0080; AF Proj. 5730)
(AD-A083904; TR-0080(5623)-1; AFRPL-TR-80-30) Avail: NTIS HC A05/MF A01 CSCL 21/2

A theoretical and analytical analysis is presented on the application of multispectral emission/absorption inversion to the retrieval of temperature and concentration profiles of tactical rocket motor plumes. Consideration is given to both monochromatic and band model spectral scales. A main conclusion drawn from the analysis is that application in the infrared on either the monochromatic or wide band spectral scale cannot yield adequate inversions for small plumes with mild temperature gradients such as those encountered for tactical rocket motor. Even under the most ideal circumstances, temperature and concentration errors up to 30% are encountered. The failing of the method is due to the lack of spatial resolution inherent in the inversion weighting functions. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

No abstracts in this category.

24 COMPOSITE MATERIALS

Includes laminates.

N80-27427 Cornell Univ., Ithaca, N. Y.
THE STATISTICAL STRENGTH OF FIBROUS MATERIALS AS INFLUENCED BY FIBER LOAD-SHARING AND GEOMETRIC CONFIGURATION Ph.D. Thesis
Roland Evan Pitt 1980 205 p
Avail: Univ. Microfilms Order No. 8015720

A linear spring model is presented for approximating the mechanics of a fiber matrix composite. It is observed that in long tubular structures, the load of a failed fiber is spread over a greater number of fibers than local load sharing predicts, but the load is mainly concentrated on the four nearest neighbors, with tapering. As the structure length becomes small in relation to the material properties, the load sharing is found to become that of equal load sharing or local sharing, depending on whether the fiber ends are uniformly deflected or uniformly stressed. The results of the linear spring model are used in the calculation of probablity distributions for the strength of small tubular and hexagonal bundles using the method of failure sequences. In both arrangements, the fibrous assembly exhibits greater mean strength and about the same variability in strength as it would under local load sharing. The linear spring model is also used in the development of a tapered load sharing rule for large tubular bundles and a local load sharing rule for large hexagonal bundles. Dissert. Abstr.

N80-27428*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MOISTURE DETERMINATION IN COMPOSITE MATERIALS USING POSITRON LIFETIME TECHNIQUES
Jag J. Singh, William R. Holt, and Willis Mock, Jr. Jul. 1980 23 p refs
(NASA-TP-1681; L-13651) Avail: NTIS HC A02/MF A01 CSCL 11D

A technique was developed which has the potential of providing information on the moisture content as well as its depth in the speciman. This technique was based on the dependence of positron lifetime on the moisture content of the composite specimen. The positron lifetime technique of moisture determination and the results of the initial studies are described. R.C.T.

N80-27429*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FEASIBILITY OF KEVLAR 49/PMR-15 POLYIMIDE FOR HIGH TEMPERATURE APPLICATIONS
Morgan P. Hanson 1980 16 p refs Proposed for presentation at the 12th Natl. SAMPE Tech. Conf., Seattle, 7-9 Oct. 1980
(NASA-TM-81560; E-521) Avail: NTIS HC A02/MF A01 CSCL 11D

Kevlar 49 aramid organic fiber reinforced PMR-15 polyimide laminates were characterized to determine the applicability of the material to high temperature aerospace structures. Kevlar 49/3501-6 epoxy laminates were fabricated and characterized for comparison with the Kevlar 49/PMR-15 polyimide material. Flexural strengths and moduli and interlaminar shear strengths were determined from 75 F to 600 F for the PMR-15 and from 75 F to 450 F for the Kevlar/3501-6 epoxy material. The effects of hydrothermal and long-term elevated temperature exposures on the flexural strengths and moduli and the interlaminar shear strengths were also studied. Author

N80-27430# Vought Corp., Dallas, Tex.
INVESTIGATION OF APPLICATION PARAMETERS AND TESTING OF RAIN EROSION COATINGS Final Technical Report
G. W. Kelly 13 Mar. 1980 93 p refs
(Contract N00019-78-C-0125)
(AD-A083578; Rept-2-30400/OR-52380) Avail: NTIS HC A05/MF A01 CSCL 11/4

This program was sponsored in order that the performance of selected rain erosion coatings might be evaluated and that those parameters affecting the performance of these materials might be studied with the goal in mind to upgrade rain erosion coatings for use on high performance aircraft. In order to realize this goal, the following characteristics of two select polyurethane materials were evaluated: coating adhesion to the reinforced composite substrates; solvent evaporation rates or 'solvent release' from each select rain erosion coating material for the purpose of reducing coating porosity of the cured material; a polymerization study related to the chemical reactivity of these moisture reactive materials after exposure to known quantities of free water; a coating familiarization study for each of the rain erosion coating materials; radar signal attenuation studies to determine signal losses through the rain erosion coating; and high-speed erosion tests for selected coating materials and primer combinations. GRA

N80-27431# Stanford Univ., Calif. Div. of Applied Mechanics.
ELASTICITY THEORY OF COMPOSITES Interim Report
J. R. Willis Mar. 1980 83 p refs
(Contract N00014-76-C-0054)
(AD-A083173; SUDAM-80-2) Avail: NTIS HC A05/MF A01 CSCL 11/4

Variational methods for estimating overall properties of composites are reviewed. Bounds that allow for general two-point correlations are emphasized and new explicit formulae are given for a two-component composite. A new general third-order bound is also given. Finally a variational treatment of wave propagation problems for random composites is presented, of which the preceding static formulation is a limiting case. GRA

N80-27432# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
CYLINDRICAL SHELLS OF BIMODULUS COMPOSITE MATERIAL
Charles W. Bert and V. Sudhakar Reddy Feb. 1980 25 p refs Proposed for presentation at the ASCE Natl. Conv., Hollywood, Fla., 27-31 Oct. 1980
(Contract N00014-78-C-0647; NR Proj. 064-609)
(AD-A083974; OU-AMNE-80-3; TR-12) Avail: NTIS HC A02/MF A01 CSCL 11/4

Certain fiber-reinforced materials, especially those with slightly curved fibers in very soft matrices, exhibit considerably smaller stiffnesses when loaded in compression than when loaded in tension. Examples are tire cord-rubber, wire-reinforced solid

propellants, and certain soft biological tissues. For purposes of analysis and design, such materials can be modeled as a bimodulus material, i.e., one having one set of stiffnesses when the fiber-direction strain is tensile and another set when this strain is compressive. Using the fiber;governed bimodulus-material model introduced several years ago by the senior author and verified for cord-rubber composites, the present authors extend their previous work on the deflection of single-layer and cross-ply laminated rectangular plates to circular cylindrical shells of the same construction. A closed-form solution is presented for a thin, freely supported, cylindrically curved panel under sinusoidally distributed loading. Numerical results are presented to show the effect of shell curvature on the neutral-surface positions and deflection. GRA

N80-27433# Texas A&M Univ., College Station. Mechanics and Materials Center.

COMPOSITE MATERIALS FOR STRUCTURAL DESIGN Annual Technical Report, 15 Jan. - 31 Dec. 1979

R. A. Schapery *et al* Feb. 1980 97 p refs

(Contract F49620-78-C-0034; AF Proj. 2307)

(AD-A083721; MM-3724-80-1; AFOSR-80-0307TR; ATR-2) Avail: NTIS HC A05/MF A01 CSCL 11/4

Summarized are research activities related to polymer-matrix composite materials in the areas of processing and dynamic mechanical testing, physical aging, delamination fracture characterization, temperature and moisture effects, finite element modelling of nonlinear viscoelastic materials, and neutron radiography. Also included are Abstracts of five M.S. theses and six papers describing several recently completed experimental and analytical research investigations of factors which pertain to processing, testing, and design of composite structures. GRA

N80-27434# Pennsylvania State Univ., University Park. Materials Research Lab.

COMPOSITE PYROELETRIC MATERIALS Final Technical Report, 1 Jul. 1978 - 30 Sep. 1979

R. E. Newnham and A. S. Bhalla 30 Jun. 1979 53 p refs

(Contracts N00014-78-C-0291; MDA903-78-C-0306; ARPA Order 3617)

(AD-A083726) Avail: NTIS HC A04/MF A01 CSCL 11/4

Pyroelectric materials develop electric charge with temperature change. They are used in thermal device applications such as surveillance, burglar alarms and vidicon night-image systems. Greater pyroelectric sensitivity is needed for many vidicon applications. We are exploring ways of increasing the pyroelectric figure-of-merit (pyroelectric coefficient/permittivity) through the use of composite materials. In this report we discuss the results of work carried out at Penn State and at the North American Philips Laboratory (Dr. J. Dougherty and Dr. W. Smith). The design principles and experimental data for a model system are described in the section entitled Pyroelectric PZT composites. For PZT-Spurrs composites with parallel connectivity, the pyroelectric figure-of-merit is more than five times larger than for a poled PZT ceramics. GRA

N80-27435# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.

VIBRATION OF COMPOSITE STRUCTURES

Charles W. Bert Mar. 1980 25 p refs Presented at Intern. Conf. on Recent Advan. in Structural Dyn., Southampton, England, 7-11 Jul. 1980

(Contract N00014-78-C-0647; NR Proj. 064-609)

(AD-A084069; OU-AMNE-80-6; TR-13) Avail: NTIS HC A02/MF A01 CSCL 11/4

The purpose of this paper is to review some of the recent contributions to the field of vibration of composite structures. The topics of fatigue and fracture, while quite important in the overall dynamic performance of composite structure, are not considered in this survey. The survey treats these topics: dynamic stiffness and damping of composite materials, beams and curved bars and rings, flat panels, and cylindrically curved panels and shells. It concludes with some suggestions for future research. It is well established that fiber-reinforced composite materials, by virtue of the geometry of the fibers acting stiffeners, behave macroscopically like homogeneous but anisotropic materials. The class of elastic symmetry depends upon the geometric arrangement of the fibers. GRA

N80-27436# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.

LARGE DEFLECTION AND LARGE-AMPLITUDE FREE VIBRATIONS OF LAMINATED COMPOSITE-MATERIAL PLATES

J. N. Reddy and W. C. Chao Apr. 1980 29 p refs

(Contract N00014-78-C-0647; NR Proj. 064-609)

(AD-A084070; OU-AMNE-80-7; TR-14) Avail: NTIS HC A03/MF A01 CSCL 11/4

Finite-element analysis of the large-deflection theory (in von Karman's sense), including transverse shear, governing moderately thick, laminated anisotropic composite plates is presented. Linear and quadratic rectangular elements with five degrees of freedom (three displacements, and two shear rotations) per node are employed to analyze rectangular plates subjected to various loadings and edge conditions. Numerical results for bending deflections, stresses, and natural frequencies are presented showing the parametric effects of plate aspect ratio, side-to-thickness ratio, orientation of layers, and anisotropy. GRA

N80-27437# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.

RESIDUAL STRESS MEASUREMENTS ON ALUMINUM--GRAPHITE COMPOSITE USING X-RAY DIFFRACTION TECHNIQUES

Swe-Den Tsai, Deepak Mahulikar, H. L. Marcus, Ismail C. Noyan, and J. B. Cohen 8 Apr. 1980 15 p refs Prepared in cooperation with Texas Univ. at Austin

(Contract N00014-75-C-0580; NR Proj. 031-733)

(AD-A083795; TR-26) Avail: NTIS HC A02/MF A01 CSCL 11/4

Metal Matrix Composites (MMCs) have generated considerable interest in the materials field, because of their potential applications in dynamic structures. A MMC with its excellent mechanical as well as physical properties carries a distinct advantage over other composite systems, particulary at high temperatures. At the same time a MMC system is characterized by heterogeneity, anisotropy and interfaces which affect those properties considerably. Interfaces have been known to influence the properties of MMCs significantly and their importance has been discussed extensively. However, the interface chemistry and its exact role in alteration of various properties is not well-known yet. One of the important things needed for better understanding of the interface is its stress state. Thermal and mechanical treatments involved in the fabrication of composite materials, give rise to triaxial residual stresses. Speculations are that these stresses, originating from the differing thermal coefficients of the reinforcement and the matrix, play an important part in the transverse properties of the MMCS. GRA

N80-27438# National Technical Information Service, Springfield, Va.

ABLATION AND ABLATIVE MATERIALS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Mar. 1980

Guy E. Habercom, Jr. Apr. 1980 168 p Supersedes NTIS/PS-79/0381 and NTIS/PS-78/0313

(PB80-807837; NTIS/PS-79/0381; NTIS/PS-78/0313) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 11D

Ablation and the properties and performance of ablative materials are covered in this bibliography. Among the materials cited are pyrolytic graphite, silicon dioxide, carbon-carbon composites, reinforced plastics, expoxy resins, and refractories. Studies include ablative flow, aerodynamic heating, erosion, and combustion. Equipment discussed in these citations are rocket nozzles, nosetips, reentry vehicles, heat shields, shock tubes, and combusiton chambers. Computer programs, spacecraft design, space simulation, mathematical models bibliography contains 161 abstracts, 16 of which are new entries to the previous edition. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also 77 *Thermodynamics and Statistical Physics.*

NBO-27439 Florida Univ., Gainesville.
SATURATED ATOMIC FLUORESCENCE AS A DIAGNOSTIC TOOL FOR FLAMES AND PLASMAS Ph.D. Thesis
James Neill Bower 1979 178 p
Avail: Univ. Microfilms Order No. 8016512

An experimental approach to the determination of three flame diagnostic parameters is developed. The experimental application of saturated atomic fluorescence to the measurement of quantum efficiency, total number density, and noise power is discussed. Data for quantum efficiency and total number density are compared to the scant literature values. Four elements and three different flame compositions are investigated. Preliminary noise power spectra are discussed as background for the use of saturated atomic fluorescence to measure noise in the atomization and nebulization processes. Dissert. Abstr.

NBO-27440 California Univ., Berkeley.
THEORETICAL STUDY OF A REACTION-DIFFUSION MODEL FOR FLAME PROPAGATION IN A GAS Ph.D. Thesis
Shao-Shiung Lin 1979 112 p
Avail: Univ. Microfilms Order No. 8014780

A system of two equations of a reaction diffusion model for flame propagation in a gas is considered. The system of two equations contains a parameter, the Lewis number, which is the ratio of the heat conduction coefficient to the coefficient of chemical species diffusion. Flame fronts are traveling wave solutions connecting an unburned gas state and the corresponding adiabatic burned gas state. Dissert. Abstr.

NBO-27441 California Univ., Berkeley.
TIME-RESOLVED SPECTROSCOPY USING SYNCHROTRON RADIATION Ph.D. Thesis
Erwin David Poliakoff 1979 109 p
Avail: Univ. Microfilms Order No. 8014844

The timing characteristics of the SPEAR beam (pulse width less than or equal to 0.4 nsec, pulse repetition period = 780 nsec) were exploited to determine dynamic behavior of atomic, molecular, excimeric, and photodissociative gas phase species excited by vacuum ultraviolet radation. Fast fluorescence timing measurements were done to determine excited state lifetimes of Kr and Xe. Pressure dependent timing studies on Xe gas at higher concentrations demonstrated some of the problems associated with previous kinetic modeling of the Xe2 system. It was found that even qualitative agreement of observed Xe2 lifetimes as a function of pressure required the assumption that the radiative lifetime was a strong function of internuclear separation. Dissert. Abstr.

NBO-27442 California Univ., Berkeley.
CROSSED BEAM REACTIVE SCATTERING OF OXYGEN ATOMS AND SURFACE SCATTERING STUDIES OF GASEOUS CONDENSATION Ph.D. Thesis
Steven Jay Sibener 1979 239 p
Avail: Univ. Microfilms Order No. 8014880

A series of beam surface scattering experiments are described which examined the internal and translational energy dependence of molecular condensation probabilities for collisions involving either CCl4 or SF6 and their respective condensed phases. It is conclusively demonstrated that excitation of a polyatomic molecule's rational and vibrational degrees of freedom can inhibit its probability of sticking upon impact with a cryogenically cooled surface. Dissert. Abstr.

NBO-27443 Purdue Univ., Lafayette, Ind.
A MULTITECHNIQUE APPROACH TO SURFACE STUDIES OF METALS AND ALLOYS USING X-RAY PHOTOELECTRON SPECTROSCOPY AND SECONDARY ION MASS SPECTROSCOPY Ph.D. Thesis
George James Slusser 1979 203 p
Avail: Univ. Microfilms Order No. 8015520

X-ray photoelectron spectroscopy (XPS or ESCA) and secondary ion mass spectrometry (SIMS) were combined into the same ultrahigh vacuum system to the study of the reactions occuring on metal and alloy surfaces. The XPS and SIMS instrumentation are contained in separate vacuum chambers, which are interconnected with a set of magnetically driven UHV-compatible sample transfer devices. The effectiveness of the approach was demonstrated in determining the effects of the interaction of charged particles on the surface electronic structure and composition of PdAg alloys of various compositions, and the reaction of CO with polycrystalline foils of Ag, Pd and PdAg alloy. The chemisorption of oxygen on these same polycrystalline foils was also investigated to elucidate the various mechanisms by which oxygen is chemisorbed on these surfaces. Adsorption of O2 is very fast on Pd, reaching saturation at 2L. Adsorption of O2 on Ag is slow, with only 0.1 monolayer of oxygen detected by XPS after 10,000 L exposure. Adsorption of O2 on the 79% PdAg alloy is similar to that of Ag. Dissert. Abstr.

NBO-27444 City Univ. of New York, N. Y.
CONFORMATION, ELECTRONIC STRUCTURE AND REACTIVITY AS PROBED BY PHOTOELECTRON SPECTROSCOPY Ph.D. Thesis
Garo Horozoglu Armen 1980 121 p
Avail: Univ. Microfilms Order No. 8014950

The He(I) photoelectron spectra (PES) of complexes of Co(III) with acetylacetone and several derivatives are reported. The ionization potentials of metal localized d-electrons and ligand pi-orbitals are used to probe the extent of metal-to-ligand pi-bonding and possible aromatic character in the chelate ring. The possibility of modifying structure, based on PES results, in order to enhance chemical reactivity is suggested. Dissert. Abstr.

NBO-27445 California Univ., Berkeley.
THE KINETICS AND MECHANISM OF THE FORMATION OF OZONE BY THE ANODIC OXIDATION OF WATER Ph.D. Thesis
Peter Chadwick Foller 1979 294 p
Avail: Univ. Microfilms Order No. 8014680

The kinetics and mechanism of the synthesis of ozone by the anodic oxidation of water is described. Relevant prior work in oxygen and ozone evolution kinetics is critically evaluated in discussions of both the optimization of ozone current efficiency, and in speculations as to the mechanism of its formation. The beta crystalline form of lead dioxide is shown to be the most effective anode material for the evolution of ozone. Ozone evolution current efficiencies in many different electrolytes are assessed, and a rationale is developed to explain their sequence. The rationale is based both on the adsorptivity of the anions on anode surfaces, and their electronegativity, that is, their ability to stabilize intermediate cationic species. In general, fluoro-anion electrolytes are found to give higher ozone yields than oxy-anion electrolytes. Dissert. Abstr.

NBO-27446 California Univ., Berkeley.
OPTICAL SPECTROSCOPY OF MOLECULES ABSORBED ON THE NICKEL (111) SURFACE Ph.D. Thesis
Antonio Rafael Gallo 1979 217 p
Avail: Univ. Microfilms Order No. 8014691

The ultraviolet spectra of various organic molecules adsorbed to a clean metal surface are studied using spectroscopic ellipsometry. An ultrahigh vacuum system equipped with a liquid helium cooled crystal holder is used to prepare and characterize a clean metal surface and control the formation of the absorbed overlayer. The first observation of excited state vibrational frequencies of pyridine and pyrazine overlayers physisorbed on the nickel (III) surface is reported. The possible interactions of the adsorbed molecule with the metal surface, and propose a geometrical structure for the adsorbed overlayer are discussed. Dissert. Abstr.

NBO-27447 Kansas State Univ., Manhattan.
REACTION PATHWAYS FOR ELECTROCHEMICALLY GENERATED RADICAL ANIONS Ph.D. Thesis

Kathy Jo Borhani 1979 135 p
Avail: Univ. Microfilms Order No. 8015243

Generation of hypovalent species (viz., carbenes and carbene radical anions) was attempted by the electrochemical reduction of precursors known to produce such species upon photolysis or thermolysis. The electrochemical techniques utilized were cyclic voltammetry, single and double potential step chronoamperometry, and controlled potential electrolysis. All reductions were performed at a platinum cathode in dimethylformamide using a tetraalkylammonium salt as the supporting electrolyte. Significant results are reported. Dissert. Abstr.

N80-27448 Purdue Univ., Lafayette, Ind.
LOW ENERGY ION MOLECULE REACTIONS IN CHEMICAL IONIZATION BY MASS-ANALYZED ION KINETIC ENERGY SPECTROMETRY Ph.D. Thesis
Douglas Cameron 1979 238 p
Avail: Univ. Microfilms Order No. 8015435

The technique of mass analyzed ion kinetic energy spectrometry (MIKES) was used to obtain structural and thermochemical information from several types of ion/molecule reactions. The site of protonation was of particular interest in terms of studying the intrinsic properties of molecules and in studying the fragmentation patterns of even-electron ions. The MIKE spectra of protonated molecular ions, in general, do not provide unambiguous results concerning the site of protonation, but with deuterium labeling evidence was obtained for ring protonation of phenol and aniline. Ethylation of these substrates was done to model the protonation process. For phenol, ring ethylation, apparently occurs exclusively, while aniline shows competitive ring and N-ethylation. Results for the protonation and ethylation of the isometric cresols and toluidines were also determined. Dissert. Abstr.

N80-27449 Cornell Univ., Ithaca, N. Y.
AN INVESTIGATION OF THE EMPIRICAL CALIBRATION METHOD IN QUANTITATIVE SECONDARY ION MASS SPECTROMETRY ANALYSIS Ph.D. Thesis
John Dean Ganjei 1979 137 p
Avail: Univ. Microfilms Order No. 8015772

The empirical calibration method for the quantification of secondary ion intensities in secondary ion mass spectrometry (SIMS) was investigated. Relative sensitivity factors derived from external standards were used to interpret sample secondary ion intensities in terms of elemental concentrations. The SIMS results were compared with the samples' elemental composition determined by other analytical techniques. Two different types of sample matrices were investigated: conducting metal alloys and insulating glass oxides. Dissert. Abstr.

N80-27450 Cornell Univ., Ithaca, N. Y.
QUANTITATIVE SECONDARY ION MASS SPECTROMETRIC ANALYSIS USING ION IMPLANTATION Ph.D. Thesis
Daniel Paul Leta 1980 163 p
Avail: Univ. Microfilms Order No. 8015689

The utility of the ion implantation technique for use in quantitative secondary ion mass spectrometry (SIMS) materials characterization was investigated. Many elemental implants into the semiconductor matrices were performed, and the resulting SIMS analysis of these materials has provided a detailed look at both the ion implantation process itself and at SIMS ion yields, sensitivities and detection limits. Dissert. Abstr.

N80-27451*# National Aeronautics and Space Administration, Washington, D. C.
OXIDATION OF GALLIUM ARSENIDE IN A PLASMA MULTIPOLE DEVICE. STUDY OF THE MOS STRUCTURES OBTAINED
Serge Gourrier, Andrei Mircea, and Francois Simondet May 1980 58 p refs Transl. into ENGLISH of "Oxydation de L'Arseniure de Callium par Plasma en L'Arseniure de Callium par Plasma en Utilisant in Dispositif Multipolaire. Etude des Structures Mos Obtenues", Rept. LEP-79/62. SME-687-A and DGRST-77-7-1638- Limeil-Brevannes, France, Dec. 1978 p 161 Translation was announced as N80-11181 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75471; LEP-79/62.SME-687-A; DGRST-77-7-1638) Avail: NTIS HC A04/MF A01 CSCL 07D

The oxygen plasma oxidation of GaAs was studied in order to obtain extremely high frequency responses with MOS devices. In the multipole system a homogeneous oxygen plasma of high density can easily be obtained in a large volume. This system is thus convenient for the study of plasma oxidation of GaAs. The electrical properties of the MOS diodes obtained in this way are controlled by interface states, located mostly in the upper half of the band gap where densities in the 10 to the 13th power/(sq cm) (eV) range can be estimated. Despite these interface states the possibility of fabricating MOSFET transistors working mostly in the depletion mode for a higher frequency cut-off still exists. E.D.K.

N80-27452*# National Aeronautics and Space Administration, Washington, D. C.
STRUCTURE OF COMPLEXES BETWEEN ALUMINUM CHLORIDE AND OTHER CHLORIDES, 2: ALKALI-(CHLOROALUMINATES). GASEOUS COMPLEXES
Magdolna Hargittai Apr. 1980 36 p refs Transl. into ENGLISH from Kem. Kozlem., v. 50, no. 4, 1978 p 489-514 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75762) Avail: NTIS HC A03/MF A01 CSCL 07D

The structural chemistry of complexes between aluminum chloride and other metal chlorides is important both for practice and theory. Condensed-phase as well as vapor-phase complexes are of interest. Structural information on such complexes is reviewed. The first emphasis is given to the molten state because of its practical importance. Aluminum chloride forms volatile complexes with other metal chlorides and these vapor-phase complexes are dealt with in the second part. Finally, the variations in molecular shape and geometrical parameters are summarized. Author

N80-27453*# United Technologies Research Center, East Hartford, Conn.
CONCEPTUAL DESIGN STUDY FOR COHERENT ANTI-STOKES RAMAN SPECTROSCOPY (CARS) DIAGNOSTICS IN THE AMMRC BALLISTIC COMPRESSOR FACILITY Final Report, Jul. - Nov. 1979
John A. Shirley and Robert J. Hall Mar. 1980 55 p refs
(Contract DAAG46-79-C-0060; DA Proj. 1L1-6110-EAH-42)
(AD-A083492; AMMRC-TR-80-7) Avail: NTIS HC A04/MF A01 CSCL 07/4

A conceptual design of a diagnostic system using coherent anti-Stokes Raman Spectroscopy (CARS) to determine time resolved temperature and species concentrations in the Army Mechanics and Materials Research Center ballistic compressor has been formulated. Performance calculations have been carried out for hydrogen which is an ideal diagnostic species for this application. Results are also presented of computer code calculations of collision narrowed spectra of nitrogen. Several pump laser systems were compared, and a high repetition frequency Nd:YAG laser was determined to be superior. Population saturation, stimulated Raman gain, and optical breakdown are not expected to pose severe limitations on laser intensity or measurement signal-to-noise ratios. Consideration is given to problems pertinent to operation of the ballistic compressor including compressor recoil, window deflections and generation of CARS from the test section windows. Finally, the possibility of using pulsed stimulated Raman gain spectroscopy (SRGS) as an alternative to CARS at the high densities typical of the ballistic compressor has been identified. SRGS appears to offer adequate measurement ability and possesses certain advantages over CARS. GRA

N80-27454# North Carolina Univ. at Chapel Hill. Dept. of Chemistry.
SYNTHESIS AND CHARACTERIZATION OF METALLO-ORGANIC CONDUCTING MATERIALS WITH TETRA-AZAANNULENES
William E. Hatfield 15 Apr. 1980 8 p refs
(Contract N00014-76-C-0816; NR Proj. 053-617)
(AD-A083765; TR-10) Avail: NTIS HC A02/MF A01 CSCL 07/3

Compounds of the macrocyclic ligand 4,11-dihydro-dibenzo(b, i)(1,4,8,11)tetraaza(14)annulene, dB-TAA, have been prepared with Cu(2-), Ni(2-), Co(2-), Pd(2-), Pt(2-). The palladium complex crystallizes in two crystalline modifications, one of which is similar to the structurally characterized compound NiIdB-TAA), while the second form packs as cofacial dimers in the solid state. GRA

N80-27455# Purdue Univ., Lafayette, Ind.
SHOCK TUBE STUDIES OF THE N2O/CH4/CO/Ar SYSTEMS
Anthony M. Dean and Ron L. Johnson Apr. 1979 43 p refs
Prepared in cooperation with Univ. of Missouri, Columbia
(Contract N00014-75-C-1143; Proj. SQUID)
(AD-A083722; SQUID-UMO-5-PU) Avail: NTIS
HC A03/MF A01 CSCL 07/4

Reflected shock waves were used to heat N2O/C2H6/CO/Ar and N2O/CH4/CO/Ar mixtures to temperatures of 1875-2855 K at total concentrations of 5 x 10 to the 18th power CC. Oxygen atom production was monitored via the flame band emission at 450 nm, and CO2 production was observed at 4.27 micrometers. These data were then compared to the results of numerical integration of the rate equations, using rate constant and mechanistic information obtained in earlier studies of H2 and CH2O under similar conditions. For the C2H6 mixture, it was possible to achieve good agreement between these calculations and the observed data using only one addition reaction O + CH3 yields CH2O + OH. The calculations were insensitive to the precise value used, but the results are consistent with recent high temperature literature values. For the CH4 mixture, the best agreement was achieved using a recent high temperature value for O + CH4 yields CH3 + OH. The data indicated that this reaction has a markedly non-Arrhenius rate constant; use of a value based upon low temperature data gives results inconsistent with those observed. The CH4 system was insensitive to any other methane reaction rate constant. There was some experimental evidence to suggest an unsuspected complexity in methyl radical decay channels at the lowest temperatures observed. The mechanism/rate constant combination used here was then applied to the analysis of literature data for CH3 oxidation by O2. This analysis was designed to obtain a value for the rate constant of CH3 + CH3 + O2 yields CH2O. GRA

N80-27456# Ohio State Univ. Research Foundation, Columbus. Dept. of Aeronautical and Astronautical Engineering.
IGNITION, COMBUSTION, DETONATION, AND QUENCHING OF REACTIVE MIXTURES Interim Report, 1 Apr. 1978 - 31 Mar. 1979
Rudolph Edse Nov. 1979 51 p refs
(Grant AF-AFOSR-3604-78; AF Proj. 2308)
(AD-A083737; AFOSR-80-0302TR) Avail: NTIS
HC A04/MF A01 CSCL 21/2

The effects of initial gas temperature, pressure, density, and energy transfer to the gas in the detonation wave have been studied to develop an equation which can be used to predict the length of transition from deflagration to detonation (induction distance) in confined and unconfined combustible gas mixtures. Flame speeds of various hydrogen-oxygen-inert gas mixtures have been measured to determine the relationship between flame speed (deflagration) and induction distance. A nozzle burner having a sine curve contour was used for these experiments to obtain well-defined laminar flame cones permitting reliable and reproducible evaluations. The quenching distances of methane-air, methane-oxygen, acetylene-air and hydrogen-air flames were not affected by potassium chloride, sodium-bicarbonate, or potassium phosphate coatings on the quenching surfaces. It was also found that the quenching distances of these flames are independent of the linear speed of the unburned gas as long as the flows are laminar. Variations of the burner width also did not affect the quenching distances. However, rather significant increase of the quenching distances were observed when the narrow sides between the quenching distances were observed when the narrow sides between the quenching surfaces were closed. New iteration formulas have been developed to simplify and reduce the computational work for calculating detonation parameters and the performance of thermal engines (ramjet, rocket, gas turbine, and internal combustion engine). GRA

N80-27457# Naval Research Lab., Washington, D. C.
COMPUTATIONAL APPROACHES TO THE STUDY OF REACTIVE FLOW MIXING Interim Report
Jay P. Boris and Elaine S. Oran 13 Feb. 1980 51 p refs
(RR0240241)
(AD-A083912; NRL-MR-4137) Avail: NTIS
HC A04/MF A01 CSCL 21/2

The presence of turbulence alters mixing and reaction times in chemically reactive flows. These effects in turn modify the heat and mass transfer rates and hence the local and global dynamics of combustion systems. The goal of this paper is to first describe the fundamental physical processes we must model to understand reactive flow turbulence and then to show how detailed ab initio modelling of these phenomena may be used to help construct phenomenological turbulence model for reactive flows. Three different aspects of reactive flow mixing are identified as focal points for the detailed modelling and several important criteria are established which an accurate and consistent sub grid reactive flow mixing phenomenology should satisfy. One possible representation for such a generalized phenomenology is presented. GRA

N80-27458# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
MATHEMATICAL THEORY OF LAMINAR COMBUSTION. CHAPTER 5: UNSTEADY BURNING OF A LINEAR CONDENSATE Interim Technical Report
J. D. Buckmaster and G. S. S. Ludford Mar. 1980 29 p refs
(Grant DAAG29-79-C-0121)
(AD-A083738; TR-107; ARO-15882.12-M) Avail: NTIS
HC A03/MF A01 CSCL 21/2

This report is Chapter 5 of the twelve in a forthcoming research monograph on the mathematical theory of laminar combustion. The unsteady burning of a linear condensate is discussed due, for example, to an impinging acoustic wave. Stability of steady states is also considered. GRA

N80-27459# ARO, Inc., Arnold Air Force Station, Tenn.
RAMAN SCATTERING STUDIES OF SOLID-PHASE SPECIES Final Report, 1 Oct. 1977 - 30 Sep. 1979
D. P. Weaver and J. W. L. Lewis AEDC Apr. 1980 41 p refs
(AD-A083926; AEDC-TR-80-4) Avail: NTIS
HC A03/MF A01 CSCL 07/4

The Raman spectra of cryosorbed samples of CO2, CO, N2, O2, CH4, NH3, and H2O were obtained. Cryodeposit thickness was nominally 10 to 11 micrometers, and sample temperatures were systematically varied over the range of 17 to 85 K. Spectral scans were obtained for both the lattice mode region (25 to 1/200 cm) and intramolecular vibrational mode region (200 to 2/4000 cm). Additionally, the Raman spectra of single polystyrene latex spheres in diameter and bulk, powdered samples of inorganic particles of NaNo3 and NH4 NO3 were recorded. The dependence of the Raman scattering signature of NaNO2 on sample temperature and the spectral variations as a function of change in concentration of a sample formed from a mixture of NaNO3 and NH3NO3 were investigated. GRA

N80-27460# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ANALYTICAL MODELS FOR THE COMPRESSIVE HEATING IGNITION OF HIGH EXPLOSIVES Final Report
John Starkenberg Mar. 1980 44 p refs
(DA Proj. 1L1-61102-AH-60)
(AD-A083889; AD-E430415; ARBRL-TR-02225) Avail: NTIS
HC A03/MF A01 CSCL 21/2

Two one-dimensional models to predict the temperature history of an explosive surface subject to compressive heating from the rapid collapse of an adjacent air layer are reported herein. Computations made using the more sophisticated finite compression-rate model show qualitative agreement with the experimental behavior while results obtained from the simpler adiabatic compression model are sometimes misleading. The most important observation is that planar one-dimensional gap closure cannot explain ignition as observed in experiments. Several multidimensional effects have been introduced into the models. The results show that enhanced energy transport caused by convection and turbulence must be present in conjunction with

rapid local pressurization and/or convergent air-flow, unless the enhancement is confined to a boundary layer adjacent to the explosive. In addition, the dieseling mechanism of sensitization has been considered indicating that explosive particle sizes small enough to exhibit increased temperature may be present. GRA

N80-27461# Wisconsin Univ. - Madison. Mathematics Research Center.
EVOLUTION OF DEFLAGRATION IN A COLD COMBUSTIBLE SUBJECTED TO A UNIFORM ENERGY FLUX
A. K. Kapila Feb. 1980 35 p refs
(Contract DAAG29-75-C-0024)
(AD-A083822; MRC-TSR-2040) Avail: NTIS
HC A03/MF A01 CSCL 21/2

The title problem is treated in the limit of large activation energy. It is shown that the evolutionary process takes place in a series of distinct stages, and the spatial and temporal structure of each stage is described. It is found that subsequent to thermal runaway, the behavior of the system resembles that of self-induced combustion, except that the thermal explosion is now confined to a thin surface layer. Burning of an initially cold combustible material is studied. It is assumed that combustion is initiated by heating the surface of the material. This will result in a chemical reaction first occurring at the surface, and then spreading through the material in the form of a flame or deflagration wave. Asymptotic methods are used to study the transient process leading to the establishment of the flame. Attention is confined to solid combustibles, but it is envisaged that the techniques developed here will aid in the eventual understanding of the evolution of gaseous combustion. GRA

N80-27462# Purdue Univ., Lafayette, Ind. Center for Information and Numerical Data Analysis and Synthesis.
THERMOPHYSICAL AND ELECTRONIC PROPERTIES INFORMATION ANALYSIS CENTER (TEPIAC). A CONTINUING SYSTEMATIC PROGRAM ON DATA TABLES OF THERMOPHYSICAL AND ELECTRONIC PROPERTIES OF MATERIALS Annual Final Report 1 Jan. - 31 Dec. 1979
Y. S. Touloukian and Cho-Yen Ho Mar. 1980 124 p refs
(Contract DLA900-79-C-1007)
(AD-A083943; AMMRC-TR-80-15) Avail: NTIS
HC A06/MF A01 CSCL 05/2

This Annual Final Report on Contract No. DLA900-79-C-1007 covers the activities and accomplishments of the Thermophysical and Electronic Properties Information Analysis Center (TEPIAC) for the period 1 January to 31 December 1979. TEPIAC's activities reported herein include literature search, acquisition, and input of source information; documentation review and codification; material classification; information organization; operation of a computerized bibliographic information storage and retrieval system; data extraction and compilation; data evaluation, correlation, analysis, synthesis, and generation of recommended values; preparation and publication of handbooks, data books, properties literature retrieval guides, state-of-the-art reports, critical reviews, and technology assessments; development of a computerized numerical data storage and retrieval system; technical and bibliographic inquiry services; and current awareness and promotion efforts. TEPIAC covers 14 thermophysical properties and 22 electronic, electrical, magnetic, and optical properties of nearly all materials at all temperatures and pressures and in all environments. GRA

N80-27463# Massachusetts Inst. of Tech., Cambridge. Ralph L. Parson Lab. for Water Resources and Hydrodynamics.
ADSORPTION OF TRACE METALS BY HYDROUS FERRIC OXIDE IN SEA WATER Ph.D. Thesis. Final Report, 1978
Francois Morel and K. C. Swallow Jan. 1980 63 p refs
Submitted for publication
(Grant EPA-R-803738)
(PB80-152804; EPA-600/3-80-011) Avail: NTIS
HC A04/MF A01 CSCL 07D

The adsorption of trace metals by amorphous hydrous ferric oxide in seawater was studied with reference to simple model systems designed to isolate the factors which may have an effect on the isotherms. Results show that the complex system behaves in a remarkably simple way and that the data obtained under various conditons of total metal concentration and total oxide concentration can be reduced to an apparent reaction constant, K which is a function of pH only, the high capacity of the oxide for trace metals renders the concept of a surface reaction useless to explain the uptake of metals. A physical picture of the oxide as a swollen hydrous gel permeable to hydrated ions is presented. GRA

N80-27464# Cincinnati Univ., Ohio. Physical and Chemical Methods Branch.
PROGRAM DOCUMENTATION FOR THE GAS CHROMATOGRAPHY AUTOMATION SYSTEM
Jonathan E. Kopke Feb. 1980 188 p
(Contract EPA-GS-05S-10458)
(PB80-166481; EPA-600/4-80-001)
Avail: NTIS HC A09/MF A01 CSCL 14B

The program listings, program flowcharts, symbol definitions, symbol references, and program descriptions of all the BASIC language programs which implement the functional specifications for an advanced chromatography automation system are presented. The structure of all data file is also completely described. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-27465 California Univ., Berkeley.
THE EFFECTS OF NON-CARBIDE FORMING ELEMENTS ON THE MECHANICAL PROPERTIES AND MICROSTRUCTURE OF A SECONDARY HARDENING STEEL Ph.D. Thesis
Warren Manford Garrison, Jr. 1979 248 p
Avail: Univ. Microfilms Order No. 8014694

The influence of additions of Si and a combination of Si and Al on the microstructure and mechanical properties of secondary hardening steels was investigated as a function of austenitizing and tempering temperatures. The secondary hardening steels with Si and Al additions showed a marked improvement in toughness with increasing austenitizing temperature, while the toughness of secondary hardening steels not containing Si or Al decreased with austenitizing temperature. It was observed that the Si and Al + Si additions delayed softening on tempering to temperatures above 550 C. The Si additions were found to completely repress the precipitation of intralath cementite and stabilized the epsilon carbides to tempering temperatures above 400 C. The fracture toughness of some of the secondary hardening steels alloyed with Si and Al was found to be over twice that of conventional medium carbon secondary hardening steels of comparable strength levels. The effect of Si and Mo on tempered martensite embrittlement was also studied. The results show that Si and Mo delay tempered martensite embrittlement to higher tempering temperatures.
Dissert. Abstr.

N80-27466 California Univ., Los Angeles.
THE SULFIDATION BEHAVIOR OF NICKEL-CHROMIUM, NICKEL-ALUMINUM, AND NICKEL-CHROMIUM-ALUMINUM ALLOYS WITH AND WITHOUT YTTRIUM Ph.D. Thesis
Evan J. Vineberg 1980 217 p
Avail: Univ. Microfilms Order No. 8016056

The sulfidation kinetics were determined using a continuous weight gain system. Mechanisms of the sulfidation reactions were deduced from the kinetics behavior, scale analyses, and morphological observations. Marker experiments were performed for several of the alloys. Analytical tools used in the study included X-ray diffraction analysis, metallographic examination, scanning electron microscopy, X-ray energy dispersive analysis, X-ray mapping, and Auger analysis. Except for the alloys with high chromium content (50 w/o chromium), the mechanism of scale formation was found to be one of counter-current diffusion with a net inward flux of sulfur. The scales were nonprotective, and linear kinetics were observed. In the presence of 50 w/o chromium, a protective Cr_2S_3 layer formed by outward cation diffusion, and parabolic kinetics were observed. The rate of sulfidation was shown to decrease with increasing chromium and aluminum concentrations. The addition of 1 w/o yttrium

consistently reduced the sulfidation rate. It is postulated that the presence of yttrium promotes the formation of a Cr2S3 and/or Al2S3 layer which is more protective than that which forms in the absence of yttrium. Dissert. Abstr.

N80-27467 California Univ., Berkeley.
AN INVESTIGATION OF THE MICROSTRUCTURE AND MECHANICAL PROPERTIES OF THICK SECTION Cr-Mo STEELS Ph.D. Thesis
Rameshchandra Jitendrakumar Kar 1979 161 p
Avail: Univ. Microfilms Order No. 8014755

An investigation was carried out to correlate the microstructure and mechanical behavior in thick section Cr Mo steels. It was found that the transformation products of slow-cooled 2.25 Cr IMo steel, consisted of mixtures of bainite and polygonal ferrite. The bainitic carbides were a mixture of interand intra-lath cementite and it was found that these played an important role during subsequent tempering. These poor properties were attributed to undesirable morphologies of the microconstituents in 2.25 Cr IMo steel. It was found that minor additions of Ni/Mn were effective in eliminating free ferrite from slow-cooled 2.25 Cr IMo. The effect of Ni/Mn alloy modification was to alter the tempering response of the continuously cooled bainites. Precipitation of alloy carbides was observed at lower temperatures than in the 2.25 Cr IMo base alloy. Temper embrittlement studies were carried out on commercial heats of 2.25 Cr IMo and two of its Ni Mn modifications. Dissert. Abstr.

N80-27468 California Univ., Berkeley.
THE MECHANISM OF MICROSTRUCTURAL CHANGE AND ITS CONSEQUENCES IN A LOW CARBON 6 NICKEL ALLOY Ph.D. Thesis
Jungihl Kim 1979 130 p
Avail: Univ. Microfilms Order No. 8014759

The mechanism of microstructural changes during a three step thermomechanical treatment and the effects of resulting microstructures on mechanical properties were investigated in a low carbon Fe-6Ni alloy. Refinement of the grain size appeared to be achieved after two step treatment. Heating by temperature cycling up to the austenite reversion temperature was found primarily to refine prior austenite grains. Controlled rolling was revealed to be an effective means to replace these thermal, cyclings. Two-phase tempering showed ultrafine grains through two phase decomposition and development of subgrains with large angle grain boundaries. In the first intercritical annealing process, regions of high alloy element concentration were provided and these regions were revealed to be preferential sites for a second two phase decomposition. The effects of the stable precipitated austenite were found to be beneficial to fracture toughness by either scavenging a deleterious carbide precipitation in the austenite or by preventing a sharp crack propagation. Dissert. Abstr.

N80-27469 Washington Univ., Seattle.
BETA DECOMPOSITION IN BINARY Ti-Cr ALLOYS Ph.D. Thesis
V. Chandrasekaran 1979 162 p
Avail: Univ. Microfilms Order No. 8013509

The transformation behavior and properties of binary Ti-Cr alloys were studied with special emphasis on the following: (1) the isothermal transformation from the metastable beta to the transitional omega phase; (2) the influence of microstructure on the temperature coefficient of electrical resistivity (TCR); (3) the mechanical properties and fracture modes associated with the beta plus omega and omega reverted microstructure. The lack of one-to-one correspondence between the beta and the omega precipitates is consistent with separate nucleation sites for the omega phase. Evidence is presented which suggests that the final transition to discrete omega particles is triggered by strain. The omega morphology is not well defined during the initial stages of precipitation. With continued aging the morphology is distinctly platelike and the omega particles form parallel to the [110] beta and [112] beta planes. The negative TCR was established as a singular property of the metastable beta phase. The TCR is very sensitive to omega precipitation and can be used to monitor the onset and progress of the omega reaction during aging and deformation. Dissert. Abstr.

N80-27470 Pittsburgh Univ., Pa.
THE STRENGTH AND PLASTIC PROPERTIES OF DILUTE COPPER-TITANIUM ALLOY SINGLE CRYSTALS Ph.D. Thesis
James Greggi, Jr. 1979 254 p
Avail: Univ. Microfilms Order No. 8015380

Cu-1.2 at percent Ti (0.9 wt percent) alloy single crystals were grown by a modified Bridgman technique and seeded to produce orientations close to the 'soft' [123] direction. Solution treated and quenched tensile specimens were aged at 673 K for times up to 2 x 10,000 min. Simple tensile tests were conducted over a temperature range extending from 77 K to 473 K at a nominal strain rate of 8.3 x 0.0001/sec. For crystals aged to contain discrete, order beta particles, plastic flow was initiated by the formation and propagation of a Luders band, followed by uniform deformation up to the maximum load. The coarse secondary slip formed as a stable Luders band at 77 K but led to tensile instability and fracutre at higher test temperatures. The yield strength and various parameters related to the deformation behavior such as workhardening rates, extent of primary slip, overshoot of the symmetry boundary, and the coarseness and disposition of the secondary slip bands were all found to vary systematically with particle size and strength and testing temperature. The aging response was initially weak but increased significantly for aging times between 10 min and 1,000 min. For aging times longer than 1,000 min, the aging response decreased sharply, but the yield strength continued to increase slowly resulting in a broad aging peak. Dissert. Abstr.

N80-27471 Pittsburgh Univ., Pa.
THE MICROSTRUCTURAL BEHAVIOR OF AUSTENITE DUE TO HOT ROLLING Ph.D. Thesis
Elliot Lewis Brown 1979 309 p
Avail: Univ. Microfilms Order No. 8015376

The microstructural behavior of High-Strength Low-Alloy (HSLA) austenite subjected to relatively simple thermomechanical treatments as well as more complexed treatments are discussed. The following areas are emphasized: (1) starting material characterization and behavior during reheating; (2) thermomechanical treatment of typical C-Mn and HSLA steel compositions in the form of single and double pass (50 percent reduction) rolling schedules; and (3) thermomechanical treatment of a model, stable austenitic material. The microstructural behavior is characterized by optical microscopy, transmission electron microscopy, electron diffraction, analysis of chemically isolated precipitates, and crystallographic texture measurement. The importance of A1N and microalloy precipitation in controlling the microstructural behavior of the steel during reheating is emphasized. Abnormal grain growth resulted at low to intermediate austenite reheat temperatures and rapid normal grain growth at high austenite temperatures. Dissert. Abstr.

N80-27472 Johns Hopkins Univ., Baltimore, Md.
THE MAGNETIC PROPERTIES OF AMORPHOUS (Fe-Ni-Co)-METALLOID ALLOYS Ph.D. Thesis
Daniel Paul Musser 1980 164 p
Avail: Univ. Microfilms Order No. 8014728

The magnetic properties of several amorphous transition metal-metalloid alloys were studied with Fe-57 Mossbauer spectroscopy. The transition metal elements in the alloys are Fe, Ni, and Co; the metalloid elements are B, P, C, and Al. The alloys studied included several series in which the Fe to Ni or Fe to Co concentration is varied, with the metalloid concentration being fixed; several in which the metalloid concentration is varied with the metal concentration being fixed; and the binary series Fe sub x B sub 100-x. Dissert. Abstr.

N80-27473*# National Aeronautics and Space Administration, Washington, D. C.
THE CRITICAL POINTS OF ALLOYS OF IRON AND COBALT DURING RAPID HEATING
V. N. Gridnev (Academy of Sciences of the Ukranian SSR, Kiev) and S. P. Oshkaderov (Academy of Sciences of the Ukranian SSR, Kiev) Apr. 1980 7 p refs Transl. into ENGLISH from Metallofizika (USSR), no. 27, 1970 p 80-84 Original language document was announced as A70-36203 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)
(NASA-TM-75825) Avail: NTIS HC A02/MF A01 CSCL 11F

The influence of the rate of heating on the position of the critical points of iron-cobalt alloys was studied. It is shown that when an alloy with 8% Co by weight is heated at the rate of 7000 deg/sec, a shift in the temperature of phase conversion of almost 30 deg occurs. When an alloy with 15% Co by weight is heated at the same rate, the conversion temperature is shifted by approximately 20 deg. For an alloy with 15% Co by weight, for which under ordinary conditions of heating the points of phase conversion and magnetic randomization (the Curie point) coincide, it was possible to show that for high rates of heating, a separation with respect to temperature occurs which clearly confirms the fact of the shift in the critical points of phase conversion. Author

N80-27474# Georgia Inst. of Tech., Atlanta. Fracture and Fatigue Research Lab.
THE EFFECT OF MICROSTRUCTURE ON THE PROPERTIES OF HIGH STRENGTH ALUMINUM ALLOYS Annual Report, Feb. 1979 - Feb. 1980
Edgar A. Starke, Jr. and T. H. Sanders, Jr. Feb. 1980 67 p refs
(Grant AF-AFOSR-3471-78; AF Proj. 2306)
(AD-A083768; AFOSR-80-0367TR) Avail: NTIS HC A04/MF A01 CSCL 11/6

This program was initiated on 1 January 1978. During 1979, the effect of copper content on the FCP behavior of four Al-6Zn-2Mg-XCu-T7351 alloys was investigated in dry air and distilled water and compared with last year's study of the T651 condition. The peak-aged-treatment exhibited a lower growth rate in dry air over the range of delta K studied, and also displayed a higher threshold and resistance to fatigue cracking near the threshold in the distilled water environment. GRA

N80-27475# Cornell Univ., Ithaca, N. Y. School of Chemical Engineering.
FUNDAMENTAL STUDIES OF THE STRUCTURE AND CHEMISTRY OF SOLID SURFACES Final Report
Robert P. Merrill Jan. 1980 27 p refs
(Contract F49620-77-C-0118; AF Proj. 2303)
(AD-A083964; AFOSR-80-0295TR; SSN-222-26-6728) Avail: NTIS HC A03/MF A01 CSCL 11/6

Decomposition of hydrazine has been studied on Ir(111) from temperatures below 200k up to 1500k using a supersonic molecular beam scattering system. The decomposition begins around 200k producing nitrogen, ammonia, and hydrogen. An extremely strong angular dependence was found for nitrogen. This is the first time normally directed emission of nitrogen has been observed for surface decomposition. A Fourier transform of the entire waveform has been utilized to deduce the details of the decomposition mechanism. Photoemission from hydrazine and ammonia on Ir(111) using high intensity polarized UV radiation has been investigated. The results are consistent with the data from the scattering experiments. AES was used to monitor the absorption of oxygen on Al(111) surfaces and was found to be dependent on both time and oxygen pressure. Further studies will concentrate on the kinetics of aluminum oxidation. GRA

N80-27476# Princeton Univ., N. J.
THE EMBRITTLEMENT OF ALLOYS UNDER IMPULSE THERMAL, PRESSURE AND CHEMICAL CONDITIONS Final Report, 1 Dec. 1978 - 30 Nov. 1979
A. Kahn Apr. 1980 8 p refs
(Grant DAAG29-79-G-0038)
(AD-A083743; ARO-1916152.2-A-MS) Avail: NTIS HC A02/MF A01 CSCL 11/6

During the past two years, we directed our metallurgical study of the embrittlement of bore surfaces toward the examination of the composition of large-calibre gun barrel surfaces via the combines SEM/SAM (Scanning Electron Microscope/Scanning Auger Microprobe) techniques. In this final report, we outline the principal results of this study. GRA

N80-27477# Pennsylvania Univ., Philadelphia.
ELECTRONIC EFFECTS OF SULFUR IN NICKEL: A MODEL FOR GRAIN BOUNDARY EMBRITTLEMENT Interim Report
C. L. Briant and R. P. Messmer 10 Apr. 1980 19 p refs Prepared in cooperation with General Electric Co., Schenectady, N.Y. Submitted for publication
(Contract N00014-79-C-0991)
(AD-A083649; TR-1) Avail: NTIS HC A02/MF A01 CSCL 11/6

This paper reports the first study employing detailed electronic structure calculations to investigate a model of grain boundary embrittlement. The results show that adding sulfur to a cluster of nickel atoms causes strong bonds to be formed between the sulfur atom and the nickel atoms nearest to it, while simultaneously weakening bonds between these nickel atoms and their neighboring nickel atoms in the cluster. As a consequence one can suggest that sulfur forms very strong bonds within the plane of the boundary but weakens metal-metal bonds perpendicular to this plane. Although, for the present, the results can be considered only as suggesting one possible embrittlement mechanism, they do demonstrate the insight which such calculations can provide into this very central question of grain boundary embrittlement. GRA

N80-27478# Georgia Inst. of Tech., Atlanta. Fracture and Fatigue Research Lab.
THE EFFECT OF ION PLATING AND ION IMPLANTATION ON THE CYCLIC RESPONSE AND FATIGUE CRACK INITIATION OF METALS AND ALLOYS Technical Progress Report, 1 Mar. 1979 - 29 Feb. 1980
S. B. Chakrabortty, S. Spooner, and Edgar A. Starke, Jr. 9 Apr. 1980 61 p refs
(Contract N00014-78-C-0270)
(AD-A083643; TR-2) Avail: NTIS HC A04/MF A01 CSCL 11/6

Fatigue crack initiation can be affected by surface phenomena and the possibility exists for improving the fatigue performance by altering the state of the surface without greatly changing bulk properties. This program was initiated on 1 March 1978, with the objective of determining the effect of ion implantation and ion plating on the cyclic stress-strain response and fatigue crack nucleation of a metal substrate. To meet this objective, we have selected surface film-substrate combinations designed to separate the various parameters, e.g., crystal structure, SFE, shear modulus, misfit, residual stress, etc., which control near surface deformation and associated crack initiation. This report summarizes our progress during the period 1 March 1979 - 29 February 1980. Three aspects of the program are discussed: (1) The effect of silver and nickel ion plating on the low and high cycle fatigue behavior of polycrystalline copper, (2) x-ray diffraction analysis of ion implanted crystals, and (3) the effect of aluminum-ion implantation on the fatigue crack initiation of polycrystalline copper. GRA

N80-27479# California Univ., Los Angeles.
DETERMINATION OF RESIDUAL STRESS BY MAGNETOMECHANICAL ACOUSTIC EMISSION
Kanji Ono, M. Shirata, and May M. Kwan Apr. 1980 22 p refs Presented at ASM Conf. on Residual Stress for Designers and Engrs., Chicago, 9-10 Apr. 1980
(Contract N00014-75-C-0419)
(AD-A084065; TR-80-01-ONR) Avail: NTIS HC A02/MF A01 CSCL 11/6

This paper presents a newly discovered method for residual stress measurements. It applies to ferromagnetic materials only, but has a greater depth of penetration than X-ray diffraction and other methods, and is nondestructive. Materials under test are subjected to alternating magnetic fields. When internal structures of magnetic domains are altered, ultrasonic waves are generated; that is acoustic emission. This magnetomechanical acoustic emission (MAE) depends on the level of residual stress. It is also affected by the chemical composition, microstructure (heat treatment) and prior cold working of the material. Basic behavior and dependencies of MAE are to be described. Several applications will be discussed, including MAE measurements on structural shapes, welds and railroad rails. GRA

N80-27480# Bureau of Mines, Albany, Oreg. Albany Metallurgy Research Center.
IRON-BASED ALLOYS STRENGTHENED BY TERNARY

LAVES PHASES
J. S. Dunning 1980 19 p refs
(PB80-157233; BM-RI-8411) Avail: NTIS HC A02/MF A01 CSCL 11F

As a possible substitute for the solid solution strengthening of chromium and nickel, the precipitation hardening characteristics of a number of binary iron-based systems in which Laves phase precipitates, such as Fe2Mo, are formed were investigated. Several hardening responses were observed, but none was ideal. The Fe-Ta binary system had the highest magnitude of hardening, even with low alloy additions, and the Fe-Mo system had unique stability at temperature. Accordingly, the Fe-Mo-Ta system was selected for study to determine if a ternary Laves phase could combine high hardening with long-term stability at elevated temperature. GRA

N80-27481# National Materials Advisory Board, Washington, D. C. Commission on Sociotechnical Systems.
ANALYSIS OF LIFE PREDICTION METHODS FOR TIME-DEPENDENT FATIGUE CRACK INITIATION IN NICKEL-BASE SUPERALLOYS Final Report
1980 96 p refs Sponsored in part by DOD, Washington, D.C.
(Contract MDA903-74-C-0167)
(PB80-158116; NMAB-347) Avail: NTIS HC A05/MF A01 CSCL 11F

The design of turbine disks for high performance aircraft gas turbine engines requires an elevated temperature, time dependent fatigue lifetime prediction method for advanced nickel base superalloys. Two prominent empirical methods, strain range partitioning and frequency modified fatigue life, contain elements that are suited to representing viscoplastic and oxidation assisted cracking but require modification to meet the requirements of turbine disk design in the early stages of use. In addition, these methods have not yet been applied successfully to the formation and link up of microcracks and thus are not suitable where this process constitutes the major portion of the initiation lifetime. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-27482 Washington Univ., Seattle.
THE BIOSYNTHESIS OF NATURAL RUBBER AND OTHER HYDROCARBON POLYMERS Ph.D. Thesis
Kevin Richard Hirschbuehler 1979 243 p
Avail: Univ. Microfilms Order No. 8012196

The rate at which rubber and/or hydrocarbon latices isolated from various plants incorporate isopentenyl pyrophosphate and sodium acetate was determined. The latices used were obtained from Hevea brasiliensis, Euphorbia tirucalli, Ficus elastica, Castilla elastica, and Manihot glaziovii. All of these latices continued to generate rubber (or hydrocarbon) after isolation. They converted isopentenyl pyrophosphate and sodium acetate to water insoluble hydrocarbon polymers. Latices isolated from various plants significantly in their rate of rubber and hydrocarbon production. Euphorbia tirucalli latex was significantly more reactive to sodium acetate incorporation than the other latices, and Hevea brasiliensis latex was significantly more reactive to isopentenyl pyrophosphate incorporation than the other latices. Dissert. Abstr.

N80-27483*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF W AND WC ON THE OXIDATION RESISTANCE OF YTTRIA-DOPED SILICON NITRIDE
Susan Schuon 30 Apr. 1980 12 p refs Presented at the Annual Meeting of the Am. Ceramic Soc., Chicago, 28-30 Apr. 1980
(NASA-TM-81528; E-9744) Avail: NTIS HC A02/MF A01 CSCL 07C

The effect of W and WC contamination on the oxidation and cracking in air of sintered Si3N4 - 8 w/o Y2O3 ceramics at 500, 750, and 1350 C is examined. A mixture of Si3N4 - 8Y2O3, milled with alumina balls, was divided into four portions. Three portions were doped with 2 w/o WC W, and 4 w/o W respectively, in order to simulate contamination during milling. The fourth portion was undoped and used on a control. The addition of W or WC did not affect the phase relationships in the system, as all bars with or without additions contained melilite as the major Si-Y-O-N phase after sintering. At 750 C, instability (rapid oxidation and cracking) of W-doped bars appears to have occurred as a result of oxidation of the tungsten containing melilite phase. No intermediate temperature instability was observed in bars containing 2 w/o WC or in bars with no additive. Specimens exposed at 1350 C had good oxidation resistance due to the formation of a protective siliceous oxide layer. A specimen containing 4 w/o W which was preoxidized at 1350 C had improved oxidation resistance at 750 C. The tendency towards oxidation and cracking of Si3N4 - 8 Y2O3 at 750 C is concluded to be related to tungsten content of the sintered bars. M.G.

N80-27484*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF STARTING POWDER CHARACTERISTICS ON DENSITY, MICROSTRUCTURE AND LOW TEMPERATURE OXIDATION BEHAVIOR OF A Si3N4/w/o Y2O3 CERAMIC
Susan Schuon and Sunil Dutta 1980 23 p refs Presented at the Ann. Meeting of the Am. Ceramic Soc., Chicago, 28-30 Apr. 1980
(NASA-TM-81536; E-490) Avail: NTIS HC A02/MF A01 CSCL 07D

The densification and oxidation behavior of Si3N4 - 8w/oY2O3 prepared from three commercial starting powders were studied. Bars of SN 402, SN 502, and CP 85/15 were sintered for 3 to 4.5 hours at 1750 C. A second set was hot pressed for 2 hours at 1750 C. The microstructures were studied by transmission electron microscopy and scanning electron microscopy, densities were determined, and the phase compositions were determined by X-ray diffraction. Densification and microstructure were greatly influenced by the starting powder morphology and impurity content. Although SN 402 exhibited the maximum weight lose, the highest sintered and hot pressed densities were obtained with this powder. All powders had both equiaxed and elongated grains. Sintered bars were composed of beta silicon nitride and n-melelite. In contrast, hot pressed bars contained beta silicon nitride, H-phase, and J-phase, but no melelite. Yttria distribution in sintered bars was related to the presence of cation impurities such as Ca, Fe, and Mg. A limited oxidation study at 750 C in air showed no instability in these Si3N4 - 8 w/oY2O3 specimens, regardless of startin powder. Author

N80-27485# Akron Univ., Ohio. Inst. of Polymer Sciences.
TEAR STRENGTH AND TENSILE STRENGTH OF MODEL FILLED ELASTOMERS
P. Dreyfuss, A. N. Gent, and J. R. Williams 10 Apr. 1980 29 p refs
(Contract N00014-76-C-0408; NR Proj. 092-555)
(AD-A083168; TR-7) Avail: NTIS HC A03/MF A01 CSCL 11/9

Measurements have been made of the tear strength, tensile strength, and energy dissipated during stretching for model filled elastomers consisting of polybutadiene with glass beads incorporated. The glass beads were pretreated with various silanes, some of which could, in principle, form covalent bonds with the polybutadiene matrix during free-radical crosslinking of the latter and some of which could not. The tear strength of the elastomer was increased by the addition of glass beads, by about 25 per cent for the largest beads, having a mean diameter of 150 micrometers. This effect is attributed to increased roughness of the tear path. The breaking elongation in tension was reduced by the addition of glass beads but the breaking stress was only seriously reduced for the least-well-adhering beads. GRA

N80-27486# Douglas Aircraft Co., Inc., Long Beach, Calif.
PRIMARY ADHESIVE BONDED STRUCTURE TECHNOLOGY (PABST). PHASE 3: TOOLING, FABRICATION AND QUALITY ASSURANCE Final Report, Feb. 1975 - Jun. 1979
K. L. Land and F. B. Lennert 15 Oct. 1979 107 p refs
(Contract F33615-75-C-3016; AF Proj. 486U)
(AD-A083228; MDC/MR/DR-983; AFFDL-TR-79-3154) Avail:

NTIS HC A06/MF A01 CSCL 11/2

The Primary Adhesively Bonded Structure Technology (PABST) program's overall objective was to demonstrate significant improvements in cost, integrity, and durability of primary fuselage structures using latest adhesive bonding techniques, materials, and processes. Accordingly, this document summarizes the findings during Phase 3, Fabrication, and details highlights of the Manufacturing and Quality Assurance effort in the areas of Tooling and Fabrication. Construction of the Full Scale Demonstration Component (FSDC) provides important performance comparisons of various bond tools, surface preparation techniques, adhesives, primers, bagging approaches and inspection methods. The fabrication of large constant and non-constant section bonded panels for the FSDC also provided invaluable manufacturing experience; established a natural testbed for validation of Phase 2, Detail Design; and yielded excellent feedback for advancement of the PABST technology in Engineering, Materials and Process, and Quality Assurance. GRA

N80-27487# Wyoming Univ., Laramie. Dept. of Mechanical Engineering.

FATIGUE BEHAVIOR OF HERCULES 3501-6 EPOXY RESIN Final Report, Sep. 1978 - Dec. 1979

David E. Walrath and Donald F. Adams 25 Jan. 1980 48 p refs

(Contract N62269-78-C-0340)

(AD-A083494; UWME-DR-004-101-1; NADC-78139-60) Avail: NTIS HC A03/MF A01 CSCL 11/9

Plates and solid rods of Hercules 3501-6 neat epoxy were cast, from which tensile, compressive and torsional shear specimens were machined. Half of the tensile specimens were moisture-preconditioned for six months at 65 C in a 98% RH environment. Room temperature static and fatigue tests were conducted, and a scanning electron microscope used to examine representative failure surfaces. Stress versus number of cycles to failure plots were prepared. GRA

N80-27488# Army Armament Research and Development Command, Watervliet, N. Y.

EFFECT OF CVD TUNGSTEN AND TaC/aC COATINGS ON THE MECHANICAL BEHAVIOR OF SiC(C)

I. Ahmad, N. Hill, and W. Heffernan Dec. 1979 49 p refs (DA Proj. 1L1-62105-AH-84)

(AD-A083395; AD-E440058; ARLCB-TR-79035) Avail: NTIS HC A03/MF A01 CSCL 11/3

Effects of the chemically-vapor-deposited tungsten and TaC coatings on the mechanical properties of silicon carbide (carbon core) filament have been investigated. In the temperature range of interest, because of the possible chemical interaction of tungsten with carbon rich silicon carbide phase on its surface and the columnar grain structure of the coating the filament was found to be embrittled. However, by controlling the initial nucleation of tungsten by adjusting the temperature, the direction of flow of reactants and filament speed, the degradation effect of the coating can be minimized. TaC coating did not decrease the strength of the filament, because it did not react with the filament and had fine grain structure. Coatings of tungsten and TaC decreased the 100 hr 2000 deg F, rupture strength of the filament from 1.9 GN/sq M (280 Ksi) to respectively 1.05 GN/sq M (150 Ksi) and 1.6 GN/sq M (240 Ksi). The tensile strength of the W coated filament was superior to that coated with TaC in the temperature range 1000-1500 deg C. Thermal cycling (room temperature - 1600 deg C) induced cracks in the TaC coating while W coating remained unaffected. GRA

N80-27489# Colorado State Univ., Fort Collins. Dept. of Chemistry.

HEAT STABLE POLYMERS: POLYQUINOLINES AND OTHER AROMATIC POLYMERS Final Report, Jan. 1977 - Dec. 1979

J. K. Stille 1 Jan. 1980 35 p refs

(Grant DAAG29-77-G-0177)

(AD-A083129; ARO-1503.12-C) Avail: NTIS HC A03/MF A01 CSCL 11/9

Polyquinolines can be synthesized by an acid catalyzed polymerization reaction that allows a variety of structural modifications, resulting in a range of chain stiffness that can be altered from a relatively flexible amorphous polymer with a moderately low glass transition temperature (250 deg C) to a rod-like molecule with a high degree of crystallinity and a high crystalline transition temperature (~550 deg C). Fibers can be spun and films cast from solution. The rigid rod polyquinolines form anisotropic solutions and, as a result, produce crystalline fibers with a high degree of orientation and a high modulus. A series of polyquinolines containing biphenylene units in the main chain were prepared in order to effect crosslinking reactions of these materials. Crosslinking took place thermally, above the Tg of the polymer, to give insoluble polymers with higher Tg's and higher moduli both above and below Tg. Transition metals catalyze the crosslinking reactions, allowing lower curing temperatures. Polyaramides, polybenzimidazoles and polyquinoxalines could be similarly crosslinked by incorporating biphenylene into these polymers. GRA

N80-27490# University Coll. of North Wales, Bangor.

A STUDY OF THE NATURE AND ORIGINS OF PYROELECTRICITY IN POLYVINYLIDENEFLUORIDE AND ITS COPOLYMERS Final Technical Report, Feb. 1978 - Oct. 1979

D. K. Das-Gupta Jan. 1980 149 p refs

(Grants DA-ERO-77-G-088; DA-ERO-78-G-004)

(AD-A084448) Avail: NTIS HC A07/MF A01 CSCL 11/9

The results of these experiments indicate that at least a large part of the polarization in PVF2 after poling is due to dipole orientation in the crystalline regions. There is ample evidence to show that crystallites are aligned by the poling field and remain in or close to this new angular position when the field is removed. Aging experiments indicate that they do not return to their original positions even after annealing at high temperature. GRA

N80-27491# Cambridge Univ. (England).

LIQUID IMPACT EROSION MECHANISMS IN TRANSPARENT MATERIALS Interim Scientific Report, 30 Sep. 1978 - 30 Sep. 1979

J. E. Field, M. J. Mathewson, and S. vanderZwaag Wright-Patterson AFB, Ohio AFWAL Nov. 1979 47 p refs

(Grants AF-AFOSR-0125-78; AF-AFOSR-3705-78; AF Proj. 2422)

(AD-A084267; AFWAL-TR-80-4057) Avail: NTIS HC A03/MF A01 CSCL 17/5

A study has been made of damage mechanisms caused by liquid drop impact on various infra-red transparent solids. Techniques are described for producing liquid jets which simulate the damage produced by impact with spherical drops. Advantages of this approach are the simplicity of the experimentation, the low construction cost and the broad range of drop size and velocity which can be covered. A hydraulic strength measuring apparatus for brittle materials is described which allows 'residual strengths' to be measured. Materials examined in this report include silicon nitride, zinc sulphide and zinc selenide. GRA

N80-27492# Universal Energy Systems, Inc., Dayton, Ohio.

ELECTRON SPECTROSCOPIC STUDIES OF SURFACES AND INTERSURFACES FOR ADHESIVE BONDING Final Report, Jan. 1977 - Aug. 1979

Gerald E. Hammer and J. T. Grant Jan. 1980 86 p refs

(Contract F33615-77-C-5040; AF Proj. 2303)

(AD-A084254; AFML-TR-79-4220) Avail: NTIS HC A05/MF A01 CSCL 11/3

This report summarizes the results from a thirty-one month research effort conducted to study the interaction of simple organic molecules on aluminum and titanium surfaces prepared for adhesive bonding using electron spectroscopic techniques. Other electron spectroscopic studies of specimens related to the surface phenomena program are also reported. GRA

N80-28032# Joint Publications Research Service, Arlington, Va.

SYSTEM OF HYGIENIC INSPECTION OF NONMETAL MATERIALS USED IN SPACECRAFT EQUIPMENT

G. I. Solomin *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 110-115 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2 Mar./Apr. 1980 p 70-74 (For primary document see N80-28015 18-51)

Avail: NTIS HC A08/MF A01

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, and 44 Energy Production and Conversion.*

N80-27493 California Univ., Berkeley.
THE COMBUSTION OF CARBON, COAL AND COAL RELATED FUELS IN AN OPPOSED FLOW DIFFUSION FLAME BURNER Ph.D. Thesis
Wing Kai Chin 1979 44 p
Avail: Univ. Microfilms Order No. 8014636

The burning characteristics of various carbonaceous fuels as well as polymethylmethacylate (PMMA) were compared and showed PMMA to have the highest regression rate. The comparison results also indicated that a high rate of volatiles yield enhances the regression rate. The relative importance of oxygen and carbon dioxide on the surface oxidation mechanism was investigated by determining the regression rates in mixtures of oxygen and carbon dioxide and comparing with that obtained in mixtures of oxygen and nitrogen. Because of the opposing effects of carbon dioxide as an oxidizing agent and heat sink, its importance in the surface combustion mechanism could not be unambiguously determined. The gaseous products from the combustion of coal at various oxygen mole fractions and oxidizer velocities were measured and showed that the ratios of carbon monoxide to carbon dioxide decreases with increasing oxygen mole fraction. Temperature profiles in the solid and gas phases and surface temperature were determined. Dissert. Abstr.

N80-27494# Pittsburgh Energy Technology Center, Pa.
THE 2ND INTERNATIONAL SYMPOSIUM ON COAL-OIL MIXTURE COMBUSTION, VOLUME 1
1979 595 p refs Symp. held at Danvers, Mass., 27-29 Nov. 1979 Sponsored by DOE 2 Vol.
(CONF-791160-Vol-1) Avail: NTIS HC A25/MF A01

The status of various coal-oil mixture (COM) programs is assessed, including production, conversion from conventional systems, and demonstration pilot plants. Additional topics include efficiency of both the COM and boilers, combustion byproducts and their environmental effects as well as effects on boilers, and storage tanks. For individual titles, see N80-27495 through N80-27508.

N80-27495# Electric Power Development Co. Ltd. (Japan).
OVERVIEW OF R&D STATUS ON COM TECHNOLOGY IN JAPAN
Yasuyuki Nakabayashi *In* Pittsburgh Energy Technol. Center The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1 1979 p 1-13 (For primary document see N80-27494 18-28)
Avail: NTIS HC A25/MF A01

General trends referring to commercialization of coal-oil mixtures (COM) in Japan are presented. Progress in research and development on COM, public interest, and government support is summarized. E.D.K.

N80-27496# Canadian Combustion Research Lab.-CANMET, Chatham (New Brunswick).
CURRENT STATUS OF THE CANADIAN COAL-OIL MIXTURE PROGRAM
H. Whaley *In* Pittsburgh Energy Technol. Center The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1 1979 13 p refs (For primary document see N80-27494 18-28)
Avail: NTIS HC A25/MF A01

A description is given of the status of four projects together with an outline of other related COM work currently being undertaken or planned in Canada. The projects include: (1) a small COM utility boiler demonstration plant, (2) determination of the rheological properties of coal-oil slurries, (3) research and development study of the preparation combustion and emission characteristics of beneficiated coal-oil mixtures, and (4) development of coal-oil slurry fuels for blast furnace injection. E.D.K.

N80-27497# Tsinghua Univ., Beijing (China). Dept. of Thermal Engineering.
PRELIMINARY CONSIDERATIONS OF THE USE OF COM IN THE EXPERIMENTAL POWER PLANT OF TSINGHUA UNIVERSITY AS AN ENERGY FUEL
Lin Hao *In* Pittsburgh Energy Technol. Center The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1 1979 17 p refs (For primary document see N80-27494 18-28)
Avail: NTIS HC A25/MF A01

The peculiarity of the Chinese energy fuels and fuel systems are described. For converting an oil fired boiler to COM, problems that may be encountered and alternative projects to be taken into consideration are discussed. Test results of viscosities and burning profiles are introduced, as well as the scheme of a COM production system and a principal sketch of an experimental power plant's burner. E.D.K.

N80-27498# New Brunswick Electric Power Commission, Fredericton.
COAL-OIL MIXTURE COMBUSTION APPLIED TO CANADIAN UTILITY BOILERS
P. J. Whalen, F. W. Davies, L. K. Lee, M. Natarajan (Montreal Engineering Co., Ltd.), and R. L. Wang (Montreal Engineering Co., Ltd.) *In* Pittsburgh Energy Technol. Center The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1 1979 17 p refs (For primary document see N80-27494 18-28)
Avail: NTIS HC A25/MF A01

Operating experience on coal in COM relating to combustion stability, boiler efficiency, boiler slagging/fouling, and equipment erosion are reported. On line oil agglomeration coal beneficiation process is discussed. Based on a nation wide survey conducted on all oil fired canadian utility boilers, cost/benefit analyses of COM conversion for several unit sizes were carried out. Potential oil savings were predicted and a correlation between boiler sizes and break even points for benefit against cost was discussed. A candidate boiler of 100 MW capacity was selected for testing COM process and combustion. E.D.K.

N80-27499# New England Power Service Co., Westborough, Mass.
STARTUP AND INITIAL FEASIBILITY TESTING ON THE SALEM HARBOR COM DEMONSTRATION
Richard M. Dunn *In* Pittsburgh Energy Technol. Center The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1 1979 16 p refs (For primary document see N80-27494 18-28)
Avail: NTIS HC A25/MF A01

An 80 MW coal fired boiler which had been converted to burn No. 6 oil was equipped with new burners and accessories to burn coal-oil mixture. A description of the 30% coal and 70% oil mixture preparation facility is given. Results of initial coal-oil mixture (COM) blending, combustion, and stack emission tests are presented along with a discussion of initial startup problems encountered. Recommendations are made for additional COM research and product development to improve reliability. R.C.T.

N80-27500# CoaLiquid, Inc., Louisville, Ky.
OPERATION OF A CENTRAL PREPARATION PLANT FOR COAL-OIL-WATER MIXTURES
G. T. Hawkins *In* Pittsburgh Energy Technol. Center The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1 1979 16 p (For primary document see N80-27494 18-28)
Avail: NTIS HC A25/MF A01

A commercial scale, preparation plant for coal oil water mixtures was constructed. The facility is capable of producing 2,500 GPH at start up, and is expandable to up to 5000 GPH, with little additional expense. Various aspects of its operation are discussed. R.C.T.

N80-27501# Tennessee Valley Authority, Chattanooga.
INVESTIGATIONS OF COAL-OIL MIXTURES AS A UTILITY BOILER LIGHT-OFF FUEL
Stephen R. Smith, Randy M. Cole, Ronald B. Cox (Tenn. Univ., Chattanooga), T. C. Derbridge (Acurex Corp., Mountain View, Calif.), R. J. Schreiber (Acurex Corp., Mountain View, Calif.), and A. K. Yasuda (Acurex Corp., Mountain View, Calif.) *In* Pittsburgh Energy Technol. Center The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1 1979 144 p refs (For primary document see N80-27494 18-28)
Avail: NTIS HC A25/MF A01

The fluid properties of unstabilized and stabilized coal-oil-water mixtures were investigated and the economics of converting light off system of a large (2600-MW) coal fired utility boiler to coal-oil-mixture firing were examined. An experimental agitator was used to determine the following: viscosity; stability; and mixing characteristics of Nos. 2, 4, and 6 fuel oil with pulverized coal. Agitation is required to obtain useful suspensions. A stabilized coal-oil-water emulsion was tested for long-term storage stability. Over a 6-month period, there was no indication of settling. An economic analysis was performed that compares COM costs to the present system using No. 2 oil and the sensitivity of COM economics to significant variables. R.C.T.

N80-27502# Tennessee Valley Authority, Chattanooga.
COAL/OIL/WATER MIXTURE STABILITY, APPENDIX A
R. H. Carty and T. T. Coburn *In* Pittsburgh Energy Technol. Center The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1 1979 33 p refs (For primary document see N80-27494 18-28)
Avail: NTIS HC A25/MF A01

The stability of a coal-oil-water mixture prepared by an ultrasonic agitation method for stabilization of the mixture was examined. A one quart sample of this mixture was obtained to determine the test procedure for analyzing other samples for stability. Test procedures as well as the results are given. R.C.T.

N80-27503# British Petroleum Co. Ltd., Sunbury-on-Thames (England).
STABLE COAL/FUEL OIL DISPERSIONS
C. J. Veal, D. R. Wall, and A. J. Groszek *In* Pittsburgh Energy Technol. Center The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1 1979 23 p refs (For primary document see N80-27494 18-28)
Avail: NTIS HC A25/MF A01

A novel method was developed for preparing very stable coal/fuel oil dispersions without the use of additives. The dispersions were handled like and substituted for fuel oils. Such dispersions have been shown to be stable at 100 C for periods of at least 13 weeks and also at higher temperatures (150 C) for at least a week. A total of 52 000 litres of such a dispersion were prepared, handled, stored and fired in a system designed primarily for heavy fuel oil. R.C.T.

N80-27504# Pittsburgh Energy Technology Center, Pa.
COMBUSTION OF COAL-OIL MIXTURES IN A 700 HP WATERTUBE BOILER
Y. S. Pan, G. T. Bellas, M. P. Mathur, and D. Bienstock *In its* The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1 1979 27 p refs (For primary document see N80-27494 18-28)
Avail: NTIS HC A25/MF A01

Coal-oil mixtures containing up to 50 percent coal by weight were successfully burned in a 700 high pressure watertube boiler, designed for oil firing, with no derating occuring. Carbon conversion efficiencies were above 98 percent and boiler efficiencies were the same as when firing No. 6 fuel oil. Combustion tests were conducted with No. 6 fuel oil mixed with Pittsburgh Seam coal pulverized to a coal particle size of 90 percent minus 200 mesh. Test results related to boiler performance, pollutant emissions, and ash deposition are presented. The equipment, instrumentation, and data acquisition system of the combustion test facility are described. The modest changes required to adapt the facility designed for oil firing to utilize coal-oil mixtures are discussed. Additional combustion tests needed to assess bottom ash accumulation and the corrosion, erosion, and fouling behavior inherent in the long duration operability of coal-oil mixtures in an oil fired boiler are underway. R.E.S.

N80-27505# Mitre Corp., Bedford, Mass.
A TEST PLAN FOR THE NEPSCO COAL-OIL MIXTURE COMBUSTION PROJECT
Oliver K. Foo, Edward M. Jamgochian, and Alberto J. Sabadell *In* Pittsburgh Energy Technol. Center The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1 1979 32 p refs (For primary document see N80-27494 18-28)
Avail: NTIS HC A25/MF A01

Test objectives include the collection of technical and economic data to evaluate system performance, operability/maintainability, availability/reliability, and costs. A continuous 12 month test period was established. Superimposed on this period are four structured test periods during which the boiler load will be maintained at preselected levels while performance tests on the preparation plant and boiler are conducted. The end use of the data collected will provide a technical and economic data base to satisfy regulatory requirements and contribute to the commercialization of COM technology. E.D.K.

N80-27506# Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo (Japan).
DESIGN CONSIDERATION OF FINE COM STORAGE
Morio Kubota, Yashuhiko Kamijo (Tsukishima Kikai Co., Ltd.), and Koichi Tamura (Satake Chemical Equipment Mfg., Ltd.) *In* Pittsburgh Energy Technol. Center The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1 1979 38 p (For primary document see N80-27494 18-28)
Avail: NTIS HC A25/MF A01

Conclusions affecting design and method of using storage tanks for COM are presented. Test items referred to include (1) an agitation test to prevent COM from setting in the tank; (2) fluidization test of COM settled in the tank; (3) still storage test of COM without agitation; (4) heat transfer in the tank; and (5) corrosion testing to determine suitable tank materials. E.D.K.

N80-27507# Hitachi, Ltd., Tokyo (Japan).
REPORT ON PUMPING CHARACTERISTIC TESTS AND PIPING PRESSURE LOSS MEASUREMENT TESTS FOR FINE COM
Isao Koyama *In* Pittsburgh Energy Technol. Center The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1 1979 28 p (For primary document see N80-27494 18-28)
Avail: NTIS HC A25/MF A01

Data were established for transport of coal-oil mixtures (COM) and developing a design for an actual plant. The tests were carried out with two types of pumps to determine their characteristics and illuminate the pressure loss characteristics for piping transportation of COM. Four types of COM, characterized by the coal brand, coal concentration, and brand of additive mixed in the COM to prevent precipitation of coal particles, were used. The results show that pump handling of the COM is possible. R.C.T.

N80-27508# Mitsui Engineering and Shipbuilding Co. Ltd., Tokyo (Japan).
***PILOT PLANT TEST ON COARSE COM SYSTEM. TESTS* ON TRANSPORTATION, DE-OILING AND COMBUSTION OF COARSE COM**
Kenichi Nagata, Akira Shiozawa, and Isao Koyama (Babcock-Hitachi K. K., Tokyo) *In* Pittsburgh Energy Technol. Center The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1 1979 41 p refs (For primary document see N80-27494 18-28)
Avail: NTIS HC A25/MF A01

The major characteristics of the coarse coal-oil-mixtures (COM) system are described. Themes for the development and status of the COM system are addressed. Design specifications and implimentation procedures for the pilot plant and other test equipment are given. R.C.T.

N80-27509*# *National Aeronautics and Space Administration.* Lewis Research Center, Cleveland, Ohio.
USE OF PETROLEUM-BASED CORRELATIONS AND ESTIMATION METHODS FOR SYNTHETIC FUELS
A. C. Antoine Jun. 1980 23 p refs
(NASA-TM-81533; E-485) Avail: NTIS HC A02/MF A01 CSCL 21D

Correlations of hydrogen content with aromatics content, heat of combustion, and smoke point are derived for some synthetic fuels prepared from oil and coal syncrudes. Comparing the results of the aromatics content with correlations derived for petroleum fuels shows that the shale-derived fuels fit the petroleum-based correlations, but the coal-derived fuels do not. The correlations derived for heat of combustion and smoke point are comparable to some found for petroleum-based correlations. Calculated values of hydrogen content and of heat of combustion are obtained for the synthetic fuels by use of ASTM estimation methods. Comparisons of the measured and calculated values show biases in the equations that exceed the critical statistics values.

Comparison of the measured hydrogen content by the standard ASTM combustion method with that by a nuclear magnetic resonance (NMR) method shows a decided bias. The comparison of the calculated and measured NMR hydrogen contents shows a difference similar to that found with petroleum fuels. Author

N80-27510*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED FUEL SYSTEM TECHNOLOGY FOR UTILIZING BROADENED PROPERTY AIRCRAFT FUELS
G. M. Reck Jun. 1980 23 p refs Proposed for presentation at 12th Congr. of the Intern. Council of the Aeron. Sci., Munich, 13-17 Oct. 1980
(NASA-TM-81538; E-492) Avail: NTIS HC A02/MF A01 CSCL 21D

Possible changes in fuel properties are identified based on current trends and projections. The effect of those changes with respect to the aircraft fuel system are examined and some technological approaches to utilizing those fuels are described. R.C.T.

N80-27511# Southwest Research Inst., San Antonio, Tex. Mobile Energy Div.
FUEL PROPERTY EFFECTS ON COMBUSTOR PERFORMANCE Final Report
C. A. Moses and D. W. Naegeli Mar. 1980 54 p refs
(Contract N00140-77-C-1345)
(AD-A084017; SwRI-MED114) Avail: NTIS HC A04/MF A01 CSCL 21/2

Two combustor rigs have been used to study the sensitivities of combustor operation to the physical and chemical properties of fuels. Eighteen fuels including synfuels were used to accentuate the properties of concern: composition, viscosity, and boiling-point distribution. Flame radiation and smoke were best correlated by hydrogen content rather than hydrocarbon structure; the soot formation was due to gas-phase reactions. Lean-blowout conditions were about the same for all fuels except that gasoline could be burned leaner at idle conditions. Ignition limits were more sensitive to volatility than viscosity. Gaseous emissions and combustion efficiency were not significantly affected by fuel properties although some sensitivity to boiling point distribution was evident. In all performance areas, the syncrude fuels correlated in the same ways as the petroleum-derived fuels except for the NOx emissions from the nitrogen containing shale oil fuel. GRA

N80-27512# Exxon Research and Engineering Co., Linden, N.J.
CARBON SLURRY FUELS FOR VOLUME LIMITED MISSILES Annual Report, Sep. 1978 - Oct. 1979
R. H. Salvesen, D. C. Rigano, W. S. Blazowski, and W. F. Taylor Nov. 1979 219 p refs
(Contract F33615-78-C-2025; AF Proj. 3048)
(AD-A084710; EXXON/PLUS.1KWX.79; AR-1; AFAPL-TR-79-2122) Avail: NTIS HC A10/MF A01 CSCL 21/4

The Air Force has contracted with ER E to develop a carbon slurry fuel with a minimum of 180,000 BTU/gal. This report provides results of the first year's effort of this twenty-seven month program. Initial results indicate that a dispersion of carbon black in JP-10 with select dispersing agents can be made that meets the BTU requirements. Preliminary results look promising. Combustion tests using a specially developed Liquid Fuel Jet Stirred Combustor (LFJSC) have demonstrated that carbon burnout efficiencies greater than 90% are achievable with 300 nm particles in residence times down to 4 ms. Homogeneous iron, lead, manganese, and zirconium catalysts at concentrations up to 1000 ppm proved ineffective as accelerators of carbon burnout. Further tests are in progress to optimize the composition of the most promising formulations and to test these materials under more vigorous conditions in order to determine their suitability for missile applications. GRA

N80-27513# Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE 1H AND 13C FOURIER TRANSFORM NMR CHARACTERIZATION OF JET FUELS DERIVED FROM ALTERNATED ENERGY SOURCES Final Progress Report, 23 Mar. 1978 - 30 Aug. 1979
H. C. Dorn 30 Aug. 1979 80 p refs
(Contract N00173-78-C-0424)
(AD-A084169) Avail: NTIS HC A05/MF A01 CSCL 07/4

Initially, four jet samples were examined in this phase of the study using gel permeation liquid chromatography. We have previously discussed these results in the six month Progress Report. Although the gel permeation approach has the advantage of nearly quantitative recovery from the chromatography column (typically greater than 95%) and high preparative loading, it suffers from two drawbacks in studies of the present jet fuels. In general, the molecular weight and/or size of the compounds present in typical jet fuels do not cover a broad range. This is an obvious result of the relatively narrow distillation range(s) used to generate the jet fuels. That is, the gel permeation approach is more ideally suited in separations involving mixtures with a broad range in size and/or molecular weight (e.g., 100-1000 MW), whereas, the jet fuels have a more narrow range (e.g., 100-250MW). GRA

N80-27514# Puerto Rico Univ., Rio Piedras. Agricultural Experiment Station.
PRODUCTION OF SUGARCANE AND TROPICAL GRASSES AS A RENEWABLE ENERGY SOURCE Annual Report, 1978 - 1979
1979 134 p refs
(Contract ET-78-S-05-5912)
(ORO-5912-T2; AR-2) Avail: NTIS HC A07/MF A01

The agronomic and economic feasibility of mechanized, year round production of solar dried biomass, through the intensive management of sugarcane and napier grass as tropical forages were investigated. Alternate tropical grasses as potential sources for intensive biomass production were also examined. The selection and breeding of new sugarcane progeny having superior biomass productivity as their principal attribute were considered. R.C.T.

N80-27515# Institute of Gas Technology, Chicago, Ill.
RESEARCH AND DEVELOPMENT OF RAPID HYDROGENATION FOR COAL CONVERSION TO SYNTHETIC MOTOR FUELS, RISER CRACKING OF COAL Quarterly Report, 1 Jul. - 30 Sep. 1979
D. A. Duncan, J. L. Beeson, and R. D. Oberle Dec. 1979 23 p refs
(Contract EX-76-C-01-2307; Proj. 61001)
(FE-2307-58) Avail: NTIS HC A02/MF A01

The technology of short residence time hydropyrolysis of lignites and coals for optimized yields of high octane gasoline blending stock constituents was developed. The design, construction, and operation of a bench scale unit (5 to 10 lb/hr) and a process development unit (50 to 100 lb/hr) were surveyed. The technical and economic aspects of large scale operation were evaluated. R.C.T.

N80-27516# Institute of Gas Technology, Chicago, Ill.
RESEARCH AND DEVELOPMENT OF RAPID HYDROGENATION FOR COAL CONVERSION TO SYNTHETIC MOTOR FUELS, RISER CRACKING OF COAL Quarterly Report, 1 Apr. - 30 Jun. 1979
D. A. Duncan and J. L. Beeson Nov. 1979 28 p refs
(Contract EX-76-C-01-2307)
(FE-2307-55) Avail: NTIS HC A03/MF A01

The effect of heating rate on the conversion of feed carbon was studied and the distribution of products among gases, hydrocarbon liquids, and spent char was evaluated. A comparison was then made of product distribution obtained by hot hydrogen processing and by concurrent heating of the lignite and hydrogen to pyrolysis temperatures. The distribution of feed carbon among carbon oxides, methane, ethane, and hydrocarbon liquids were similar, and the yield of hydrocarbon liquids was practically identical. Equipment problems encountered thus far were minor and were easily corrected. An equipment flow sheet for a process plant was developed and various processing options were evaluated. DOE

N80-27517# Institute of Gas Technology, Chicago, Ill.
RESEARCH AND DEVELOPMENT OF RAPID HYDROGENATION FOR COAL CONVERSION TO SYNTHETIC MOTOR FUELS, RISER CRACKING OF COAL Annual Report, 1 Apr.

1978 - 31 Mar. 1979
D. A. Duncan, J. L. Beeson, and R. D. Oberle Sep. 1979 128 p refs
(Contract EX-76-C-01-2307; Proj. 61001)
(FE-2307-50) Avail: NTIS HC A07/MF A01

The effects of operating pressure and heating rate on reactor performance were studied. Several techniques for processing coking coals were explored and trails of bentonite clay and iron oxide as catalysts were made. Certain aspects of the process development unit in the operation of the preheater as well as in the operation of the combustor sections were clarified. The major observations and results are reported. DOE

N80-27518# General Electric Co., Wilmington, Mass. Direct Energy Conversion Programs.
HYDROGEN PRODUCTION USING SOLID-POLYMER-ELECTROLYTE TECHNOLOGY FOR WATER ELECTROLYSIS AND HYBRID SULFUR CYCLE Final Report, Sep. 1979
J. M. Sedlak, J. H. Russell, A. B. LaConti, D. K. Gupta, J. F. Austin, and J. S. Nugent Sep. 1979 130 p refs
(EPRI Proj. 1086-3)
(EPRI-EM-1185) Avail: NTIS HC A07/MF A01

The comparative technoeconomics of hydrogen production using the solid polymer electrolyte technology was evaluated. Two advanced processes were emphasized: water electrolysis; and hybrid sulfur cycle water decomposition. It is concluded that the solid polymer electrolyte based hybrid sulfur cycle process shows no technological or economic advantage over existing (solid polymer electrolyte based) water electrolysis systems for the production of hydrogen. DOE

N80-27519# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
RAPID ETHANOL PRODUCTION VIA FERMENTATION
Brian Maiorella, Harvey W. Blanch, and Charles R. Wilke Nov. 1979 29 p refs Presented at the Am. Inst. of Chem. Eng. Meeting, San Francisco, 29 Nov. 1979
(Contract W-7405-eng-48)
(LBL-10219; CONF-791108-19) Avail: NTIS HC A03/MF A01

The flash ferm process for industrial rapid ethanol fermentation with ethanol removal and concentration in an auxiliary flash vessel was developed. The super high productivities (80-g ethanol/L hr) of the vacu-ferm processes were maintained and many advantages were eliminated. Flash ferm continued synergistically with a vacuum distillation to provide a high ethanol concentration feed to the less strongly pinch limited separate. A 42% savings and a 54% reduction in manufacturing cost (exclusive of feed) was achieved as compared to conventional bath processes. DOE

N80-27520# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
CATALYTIC LIQUEFACTION OF BIOMASS
Manu Seth, Roger Djafar, Gary Yu, and Sabri Ergun Nov. 1979 46 p refs Presented at Thermochem. Conversion Contractor's Meeting, Rolla, Mo., 7 Nov. 1979
(Contract W-7405-eng-48)
(LBL-10091; CONF-791166-1) Avail: NTIS HC A03/MF A01

Two concepts for biomass liquefaction are considered. The first involves solvolytic depolymerization of wood followed by hydrogenation of the resulting slurry (or solution). The second entails the hydrolysis of wood followed by hydrogenation of the hydrolyzed slurry. Acid-catalyzed transfer of hydrogen from solvent molecules is being tested for the hydrogenation step. The effects of process variables on the yields and quality of products are being studied for three catalysts: sodium carbonate, ferric chloride and hydrogen iodide. The effects of reaction temperature, residence time, catalyst concentration, pressure of reducing gases and type of feed (e.g., pre-hydrolyzed slurry vs wood flour) were determined for the ferric chloride system. DOE

N80-27521# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
PROCESS DEVELOPMENT STUDIES ON THE BIOCONVERSION OF CELLULOSE AND PRODUCTION OF ETHANOL
Charles R. Wilke and Harvey W. Blanch Sep. 1979 58 p refs
(Contract W-7405-eng-48)
(LBL-9909) Avail: NTIS HC A04/MF A01

The biosynthesis of ethanol from cellulose is discussed. The following topics are covered: enzymatic hydrolysis of bagasse; high pressure hydrogen chloride process; cellulase; enzyme recovery; media development and growth factors in ethanol fermentation; process development studies on ethanol production; xylase fermentation; and isolation of xylase fermenting organisms. Cost determinations for both enzymatic and acid hydrolysis are given. DOE

N80-27522# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
PROCESS DEVELOPMENT STUDIES ON THE BIOCONVERSION OF CELLULOSE AND PRODUCTION OF ETHANOL
C. R. Wilke and Harvey W. Blanch Jun. 1979 39 p refs
(Contract W-7405-eng-48)
(LBL-9220) Avail: NTIS HC A03/MF A01

Trichoderma viride strain C-30 was evaluated by comparing cellulose productivity with strain QM 9414. Fermentation operations were conducted in 5-liter New Brunswick fermentors. The medium was used for all experiments except that urea was deleted from the medium unless otherwise indicated. Ball-milled solka floc (BW 200) at 1.0% concentration was used as a substrate. Four day old, 10 percent mycelium inoculum was used for all fermentations. The pH was adjusted with 2N NaOH and 2N H2SO4. It is shown that there is an increase in cellulose enzyme activities in addition to an increase in soluble protein. The addition of urea to the fermentation medium effects all the activities except beta-glucosidase and soluble protein. There is a three fold increase in beta-glucosidase activity at 25 C as compared to other temperatures. The increased potency in terms of glucose production is probably due to the selectively higher level of beta-glucosidase in the culture filtrate. The higher level of beta-glucosidase would permit more rzpid conversion of cellobiose to glucose. R.C.T.

N80-27523# Argonne National Lab., Ill. Systems Engineering and Technology Group.
HYCSOS: HYDRIDE CONVERSION AND STORAGE SYSTEM SENSITIVITY ANALYSIS
Jeffrey S. Horowitz Sep. 1979 19 p refs
(Contract W-31-109-eng-38)
(ANL/EES-TM-63) Avail: NTIS HC A02/MF A01

The hydride conversion of solar energy system (HYCSOS) chemical heat pump was developed. A computer program was also developed to design a HYCSOS system. Although it is recognized that the program used is not entirely correct, it is felt that studies of this kind are valuable for determining the important parameters of the system design. Results of test studies are discussed. DOE

N80-27524# McKee (Arthur G.) and Co., Cleveland, Ohio.
COAL: AN ALTERNATE FUEL FOR THERMAL ENHANCED OIL RECOVERY STEAM GENERATION Final Report
Aug. 1979 98 p
(Contract EX-76-C-01-2418)
(SAN-2418-1) Avail: NTIS HC A05/MF A01

The technical and economic aspects of using coal to replace lower tier crude oil as fuel for thermal enhanced oil recovery steam generation is examined. Three coal technologies were evaluated: coal-oil mixtures; coal gasification; and fluidized bed combustion. Coal-oil mixtures and coal gasification were evaluated for retrofit application. Fluidized bed combustion was evaluated from the standpoint of providing replacement or future steam generating capacity. DOE

N80-27525# National Technical Information Service, Springfield, Va.
COAL GASIFICATION TECHNOLOGY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1979 - Apr. 1980
Diane M. Cavagnaro Apr. 1980 224 p Supersedes NTIS/PS-79/0516 and NTIS/PS-77/0305
(PB80-808090; NTIS/PS-79/0516; NTIS/PS-77/0305) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 07A

Research reports on coal gasification are cited. They cover the techniques and processes of the conversion of coal to

chemicals or fuels. Coal desulfurization, cleaning, or preparation, which do not involve conversion to gaseous fuels or chemical, are not covered. Also excluded are in-situ gasification studies. This updated bibliography contains 217 abstracts, 172 of which are new entries to the previous edition. GRA

N80-27528# National Technical Information Service, Springfield, Va.
COAL LIQUEFACTION TECHNOLOGY. CITATIONS FROM THE NTIS DATA BASE Progress Report, May 1978 - Apr. 1980
Diane M. Cavagnaro Apr. 1980 227 p Supersedes NTIS/PS-79/0375 and NTIS/PS-77/0305
(PB80-808108; NTIS/PS-79/0375; NTIS/PS-77/0305) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 07A

A bibliography containing 217 citations on the techniques and processes of the conversion of coal to liquid chemicals or fuels is given. Most aspects of the processes including design, performance evaluation, cost analysis, and plant equipment are covered. GRA

N80-27527# National Technical Information Service, Springfield, Va.
COAL GASIFICATION TECHNOLOGY. CITATIONS FROM THE NTIS DATA CENTER Progress Report, May - Dec. 1978
Diane M. Cavagnaro Apr. 1980 152 p
(PB80-808082) Avail: NTIS HC $30.00/MF $30.00 CSCL 07A

This bibliography cites research reports on coal gasification technology. The citations discuss the techniques and processes of the conversion of coal t · chemicals or fuels coal desulfurization, cleaning, or fuels on che ·icals, are not covered. Also excluded are in-situ gasification stu...as. This updated bibliography contains 145 abstracts, none of which are new entries to the previous edition. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-27528 California Univ., Los Angeles.
A STUDY OF PERSISTENT CURRENT IN SUPERFLUID 4He Ph.D. Thesis
Talaghany Roset Khosropour 1980 116 p
Avail: Univ. Microfilms Order No. 8015996

Decay of persistant currents in superleaks in contact with bulk superfluid helium was studied using Doppler shifts of the acoustic modes of an annular resonator partially packed with superleak. The two acoustic modes are an interpolated first-fourth sound and a modified second sound. They have proven to be a usefull means of measuring persistant currents in both the packed and unpacked regions of the waveguide measured at 1.35 K for annuli 10,20, 40, 60, 80, 90, 95, and 100 percent filled with superleak. The main result, which is somewhat surprising, is that the saturated persistent current and its fractional decay rate varies only slightly with superleak depth. This means that the stability of the current in powder is neither affected by the free exchange of mass between the two regions nor is it a strong function of the magnitude of the depth of the powder. Starting from 100% packing the fractional decay rate is about 2% per decade and increases to about 3% per decade at 10% packing. However, there exists a local maximum in decay rate at 90% packing). Another phenomenon which was also studied is the Doppler shift of gravity waves in a partially packed annalus, in relation to its possible application in the detection of persistent currents. Dissert. Abstr.

N80-27529# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
DOUBLY-ASYMPTOTIC, BOUNDARY-ELEMENT ANALYSIS OF NONLINEAR SOIL STRUCTURE INTERACTION Final Report, 14 Nov. 1977 - 30 Jun. 1979
P. G. Underwood and T. L. Greer 30 Jun. 1979 68 p refs (Contract DNA001-78-C-0026)
(AD-A083330; AD-E300725; LMSC/D673964; DNA-4953F) Avail: NTIS HC A04/MF A01 CSCL 20/11

This report describes a doubly-asymptotic (DA), boundary-element (BE) treatment of a surrounding nonlinear soil medium for dynamic soil structure interaction analysis. Linear soil structure interaction is reduced to a surface relationship that is asymptotically exact at both high and low frequencies. Nonlinear soil structure interaction is treated similarly, except a volume contribution is added in the volume; a quasi-static and quasi-dynamic (axisymmetric) problem for which finite-element solutions have been obtained for comparison. For soil behavior based on J sub 2-plasticity theory, reasonable agreement is obtained. For soil behavior based on the Cap model, which is a combined I sub 1- and J sub 2-plasticity theory agreement is not obtained. GRA

N80-27530# Kentucky Bureau of Highways, Lexington. Div. of Research.
ROAD RATER AND BENKELMAN BEAM PAVEMENT DEFLECTIONS Interim Report
Gary W. Sharpe and Herbert F. Southgate Jun. 1979 42 p refs
(PB80-158439; RR-523) Avail: NTIS HC A03/MF A01 CSCL 13B

The Benkelman beam is one of the most commonly used methods of measuring surface deflections of a highway pavement. A Benkelman beam is based on a simple lever-arm principle and uses dial gauges to measure surface deflection under an applied load. The Road Rater applies a sinusoidal force to the pavement at a fixed frequency; surface wave velocities are measured and electronically integrated to obtain surface deflections. Since 1971, work has progressed toward the development of a pavement evaluation methodology using Road Rater deflections. Analyses presented illustrate some relationships between the Benkelman beam and Road Rater deflections. Theoretical and field measured deflections are considered. GRA

N80-27531# Texas Transportation Inst., College Station.
PERFORMANCE OF OPEN-GRADED FRICTION COURSES Final Report, Sep. 1977 - Jun. 1979
S. C. Britton, B. M. Galloway, and R. L. Tomasini Jun. 1979 259 p refs Sponsored in part by Texas State Dept. of Highways and Public Transportation and FHWA
(PB80-162985; TTI-2-9-78-234-1F; FHWA/TX-79/28+234-1F) Avail: NTIS HC A12/MF A01 CSCL 13C

A method for accurately determining open graded asphalt friction course (OGAFC) layer permeability was developed. Specific empasis was placed on predicting the rainfall intensity which causes incipient flooding of the pavement surface. It is shown that this method can be applied for field measurements to monitor the internal drainage capacity of OGAFC overlays when they are constructed as well as to assess changes in this aspect of performance that may result from layer densification by traffic. It is further indicated that such permeability measurements appear to be more practical and meaningful as OFAFC drainage capacity indicators than air void determinations. R.C.T.

N80-27532# California Univ., Richmond. Earthquake Engineering Research Center.
OPTIMUM INELASTIC DESIGN OF SEISMIC-RESISTANT REINFORCED CONCRETE FRAME STRUCTURES
Stan W. Zagajeski and Vitelmo V. Bertero (Colorado State Univ., Fort Collins) Jan. 1980 122 p refs
(Grant NSF ENV-76-01419)
(PB80-164635; UCB/EERC-80/03) Avail: NTIS HC A06/MF A01 CSCL 13M

The preliminary design phase of a proposed inelastic design procedure comprises three steps: preliminary analysis, preliminary design, and analysis of the preliminary design. Seismic design story shears are found by a spectral modal analysis technique which includes an approximation to the P-delta effect. A nonlinear optimization technique (the cutting-plane method) is employed at each story to find the beam design moment capacities which minimize a function proportional to the volume of flexural reinforcement. Design constraints are imposed to ensure that a safe, serviceable, and practical design results. Actual member design is found employing computer design aids. In the final

step, the preliminary design is analyzed to evaluate its acceptability. Acceptability is determined by comparing the results of a series of linear elastic and nonlinear analysis with established design criteria and assumptions made in formulating the design problem. GRA

N80-27533# California Univ., Berkeley. Earthquake Engineering Research Center.
HYSTERIC BEHAVIOR OF REINFORCED CONCRETE STRUCTURAL WALLS
J. M. Vallenas, V. V. Bertero, and E. P. Popov Aug. 1979 258 p refs
(Grant NSF ENV-76-04283)
(PB80-165905; UCB/EERC-79/20; NSF/RA-79-350) Avail: NTIS HC A12/MF A01 CSCL 13M

The behavior of reinforced concrete structural walls subjected to high shear earthquake loading conditions is studied. Results of eight earthquake simulation tests on 1/3 scale structural R/C wall subassemblage model specimens are presented. Details of the test set up, the models tested, and the test procedure are summarized. The main experimental results are evaluated in terms of the hysteretic characteristics (strength, deformation, and energy dissipation capacity), the modes of failure, ease of construction, and effectiveness of repair. Present code design methods for walls are assessed, the seismic-resistant design implications of the results are discussed, and areas of further study are recommended. GRA

N80-27534# California State Dept. of Transportation, Sacramento.
DEVELOPMENT OF A REBAR DOWEL ANCHORAGE SYSTEM FOR ATTACHING THE CALIFORNIA TYPE 25 CONCRETE BARRIER TO EXISTING BRIDGES Final Report
J. P. Dusel, Jr. and J. R. Stoker Jun. 1979 127 p refs Sponsored in part by DOT
(PB80-161722; TL-636871; FHWA/CA-TL-79-16) Avail: NTIS HC A07/MF A01 CSCL 13B

An anchorage system for attaching New Jersey-shaped concrete bridge replacement barrier onto existing concrete decks was developed. Initially dynamic pullout tests of rebar dowels were conducted to develop methods which would maximize pullout strengths. Ultimate pullout loads ranging from 25.0 kips to 34.8 kips were attained with individual no. 6 rebar dowels. Secondly, static load tests were performed on standards California Type 25 concrete barrier and replacement barriers to determine maximum horizontal loads which could be resisted. In preliminary tests, two 3-foot lengths of replacement barrier, attached with grouted no. 6 rebar dowels, withstood higher horizontal loads than did the standard Type 25 concrete barrier. A 16-foot-long replacement barrier withstood a maximum static horizontal load of 93 kips applied to a concentrated area about 26 inches above the deck surface. GRA

N80-27535# Enviro Control, Inc., Rockville, Md.
CRITERIA FOR A RECOMMENDED STANDARD: OCCUPATIONAL EXPOSURES IN COAL GASIFICATION PLANTS
Sep. 1978 206 p refs Sponsored in part by EPA
(Contract PHS-210-76-0171)
(PB80-164874; DHEW/PUB/NIOSH-78-191) Avail: NTIS HC A10/MF A01 CSCL 06J

The criteria and standards applicable to exposure of employees to toxicants and hazardous operating conditions in commercial coal gasification plants are reported. Several aspects of preventative maintenance are discussed with specific emphasis on employee workplace monitoring and medical surveillance. R.C.T.

N80-27536# Enviro Control, Inc., Rockville, Md.
RECOMMENDED HEALTH AND SAFETY GUIDELINES FOR COAL GASIFICATION PILOT PLANTS Interagency Energy-Environment Research and Development Program Report
Jan. 1978 240 p refs
(Contract PHS-210-76-0171)
(PB80-164890; DHEW/PUB/NIOSH-78-120; EPA-600/7-78-007) Avail: NTIS HC A11/MF A01 CSCL 06J

Potential hazards to workers in coal gasification pilot plants are identified and hazard control strategies are presented. Worker protection measures such as safe work practices, personal protective equipment and clothing, industrial and personal hygiene, workplace and medical monitoring, labeling and posting, hazard information and awareness, and recordkeeping are emphasized. Although this document is specific for pilot scale coal gasification plants, many of the potential hazards and research and development needs identified are transferable to those of bench or demonstration scale coal gasification or coal liquefaction facilities. GRA

N80-27537# Maine Dept. of Transportation, Bangor. Materials and Research Div.
FRICTIONAL RESISTANCE OF PAVEMENTS Interim Report
D. A. Madden Jun. 1979 28 p
(PB80-162652; FHWA/ME-TP-79-4) Avail: NTIS HC A03/MF A01 CSCL 13B

The frictional variation of roadways in the state of Maine were investigated. The magnitude and cause(s) of traverse and seasonal frictional variation were determined. The effects of time (long term) on pavement frictional characteristics were examined. GRA

N80-27538# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
INELASTIC SEISMIC RESPONSE OF A TORSIONALLY UNBALANCED SINGLE-STORY BUILDING MODEL
H. M. Irvine and G. E. Kountouris Jul. 1979 172 p refs
(Grant NSF ENV-77-14174)
(PB80-164197; NSF/RA-790389; R79-31; Rept-2) Avail: NTIS HC A08/MF A01 CSCL 13M

The dynamic effects of coupling between torsion and translocation using a simple torsionally unbalanced single-story building model are described. The investigation deals with a two-degree-of-freedom model in which two frames support a diaphragm the center of mass of which may be offset from the center of stiffness. A comprehensive parameter study was undertaken to identify trends in the peak ductility demands of the worst situated frame. A simple frequency domain analysis outlines why the peak ductility demands occur in the frame farthest from the center of mass. The study indicates that the most important parameter is one involving the product of diaphragm mass and spectral acceleration normalized by a yield level in the frame. GRA

N80-27539# National Bureau of Standards, Washington, D.C. Building Economics and Regulatory Div.
STANDARDIZATION IN FRANCE Final Report
I. M. Martinez Mar. 1980 66 p
(PB80-162126; NBSIR-79-1959) Avail: NTIS HC A04/MF A01 CSCL 05A

An overview of the voluntary standards system in France is presented. The following aspects of the French standard system are examined: (1) organization, (2) French standards, (3) standards development, (4) certification, (5) government use of standards, (6) the role of consumers and labor in standardization, and (7) France's participation in international standards activities. GRA

N80-27540# New Jersey State Dept. of Transportation, Trenton. Bureau of Structures, Materials and Applied Mechanics Research.
PREFORMED ELASTOMERIC JOINT SEALERS FOR BRIDGES. PHASE 2: EXECUTIVE SUMMARY REPORT Final Report
George S. Kozlov Jul. 1979 19 p
(PB80-162845; Rept-80-006-7731; FHWA/NJ-80-006) Avail: NTIS HC A02/MF A01 CSCL 13B

An effort to develop a realistic material specification closely related to the actual field performance of sealers is described. A method for testing the life expectancy of performed elastomeric bridge sealers is also described and the data gathered through such testing are presented. GRA

N80-27541# New York State Dept. of Transportation, Albany. Engineering Research and Development Bureau.

PATCHING FLEXIBLE AND RIGID PAVEMENTS Final Report
Leonard Hartvigas Oct. 1979 49 p
(PB80-161243; RR-74; FHWA/NY/RR-79/74) Avail: NTIS HC A03/MF A01 CSCL 13B

Available patching materials for both flexible and rigid pavements were evaluated. An infrared heater was also used for cold weather flexible pavement patching. Cold mix and a proprietary mix were used to fill potholes in flexible pavements during two winters; the more expensive proprietary mix proved to be a durable repair material for winter patching. Summer patching was not investigated on flexible pavements because the standard top course mix is used and presents no problems. Fourteen cement base and two asphalt base materials were used to repair rigid pavement. Six cement and one asphalt base materials were used in winter, with only the latter providing good service. GRA

N80-27542# Texas Transportation Inst., College Station.
FLEXIBLE PAVEMENT DEFLECTION EQUATION USING ELASTIC MODULI AND FIELD MEASUREMENTS Final Report
Robert L. Lytton and Chester H. Michalak Aug. 1979 63 p Sponsored in part by Texas State Dept. of Highways and Public Transportation
(PB80-159247; TTI-2-8-75-207-7F; FHWA/TX-79/164207-7F) Avail: NTIS HC A04/MF A01 CSCL 13B

A method of predicting the vertical deflections in a multilayered flexible pavement is summarized. The method has the following four characteristics: (1) it is based upon elastic layered theory; (2) it makes use of material properties that can be determined by nondestructive testing in the field; (3) it is simple enough that deflection calculations can be made very rapidly and inexpensively on a computer; and (4) it uses the elastic modulus of materials since that property can be measured in the laboratory. GRA

N80-27543# California Univ., Berkeley. Structures and Materials Research.
NONLINEAR GEOMETRIC, MATERIAL AND TIME DEPENDENT ANALYSIS OF REINFORCED AND PRESTRESSED CONCRETE SLABS AND PANELS Report of Structures and Materials Research
Johannes VanGreunen and A. C. Scordelis Oct. 1979 286 p (Grant NSF ENV-77-00146)
(PB80-167349; UC-SESM-79-3) Avail: NTIS HC A13/MF A01 CSCL 13C

A numerical procedure was developed for the material and geometric nonlinear analysis of reinforced and prestressed concrete slabs and panels including the time dependent effects due to load history, temperature history, creep, shrinkage and aging of the concrete, and relaxation of prestress. The procedure, based on the finite element method, is capable of predicting the response of these structures throughout their service load history as well as throughout elastic, cracking, inelastic, and ultimate load ranges. An updated Lagrangian formulation is employed to take the effects of changing structural geometry on the response of planar structures into account. Slabs or panels having an arbitrary tendon layout with either pretensioned, or bonded or unbonded post-tensioned tendons can be analyzed. A series of numerical examples is presented to study the validity and applicability of the method. GRA

N80-27544# Oklahoma State Univ., Stillwater. Fluid Power Research Center.
FIRE-RESISTANT HYDRAULIC FLUID SAFETY Final Report, 3 Aug. 1978 - 3 Aug. 1979
E. C. Fitch and J. S. Campbell 3 Aug. 1979 53 p refs (Contract DI-BM-J0-166054)
(PB80-159486; BM-OFR-33-80) Avail: NTIS HC A04/MF A01 CSCL 13K

Fire resistant hydraulic fluid safety from three directions are discussed. Results of a survey prepared for the fire resistant hydraulic journal are analyzed. Operational limitations of fire resistant hydraulic fluids are examined. Laws and standards of various foreign countries are investigated. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-27545 British Broadcasting Corp., Kingswood (England). Engineering Div.
ENHANCED UK TELETEXT MOVES TOWARDS STILL PICTURES
J. P. Chambers Jun. 1980 31 p refs
(BBC-RD-1980/4) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Methods are proposed for the enhancement of the UK teletext system leading towards a high-definition still picture capability in addition to row of text and mozaic graphics. A teletext system is described wherein binary code groups are formed into data-lines for inclusion in the television field blanking interval. The control and address information carried on each dataline, together with the special page-header data-lines and the sequence of transmission of the data-lines, allow the data-lines corresponding to the rows of a selected page to be identified. The page structure can be used to send information other than pages of text. Certain data-lines can be used for functions unrelated to teletext. In addition, techniques utilizing a multipage store are examined for improving access; and teh extension of the character repertoire to enhance multilanguage capabilities is addressed. M.G.

N80-27546 California Univ., Los Angeles.
MAGNETOSPHERIC PULSATIONS: MODEL AND OBSERVATIONS OF STANDING ALFVEN WAVE RESONANCES Ph.D. Thesis
Howard Joseph Singer 1980 209 p
Avail: Univ. Microfilms Order No. 8016043

Observations of ultra low frequency waves in the Pc 3,4, and 5 period range (10 to 600 sec) are presented. The generation of the waves is examined and the structure and distribution of these waves in space provides evidence to support the notion that many of the waves are standing Alfven wave resonances of the earth's magnetic field lines. In addition, the results of a theoretical model of standing Alfven wave resonances in a realistic magnetospheric magnetic field geometry are presented. Using the basic MHD equations, an equation is derived for the amplitude and period of low frequency transverse standing waves in an arbitrary field geometry. The Olson-Pfitzer field model which includes ring, tail and boundary currents is used, and the results indicate that the predicted period of oscillation can be quite different from that predicted by previous models in dipole field geometries. One important use for the model is for determining densities along field lines in space from ground based obeervations. Dissert. Abstr.

N80-27547 Cornell Univ., Ithaca, N. Y.
SPECTRA FROM 50 MHz AURORAL RADAR ECHOES Ph.D. Thesis
Roger Wesley Reed 1980 175 p
Avail: Univ. Microfilms Order No. 8015731

Auroral radar observations made with a radar system operating at 50 MHz with a power of about 10KW and a long dipole array antenna are examined. The radar points north and obtains echoes over a region which extends approximately from L=3.5 to L=5.5. Typical observations had a spatial resolution of 5 to 10 km and temporal resolution of 2s. The early morning of April 1, 1976 was a magnetically very disturbed period with K sub p =8. Some unusual spectra with a very narrow peak at a Doppler shift of about 70 Hz were observed at the southern edge of the westward electrojet, a region where large field-aligned currents are expected. These echoes persisted while the location of the echoing region moved poleward at an average velocity of approximately 1 km/s. Ion cyclotron waves occuring in the lower F-region are a possible scattering source for these unusual spectra. Multiple spectral peaks occured, sometimes with one spectrum containing peaks with both negative and positive Doppler shifts. The structure observed extended to the limits of both spatial and temporal resolution. Implications of these

observations to the instability theories and to ideas on the nature of the auroral electrojet are discussed. Dissert. Abstr.

N80-27548 State Univ. of New York at Buffalo.
HIGH CAPACITY LOW DELAY PACKET BROADCASTING MULTIACCESS SCHEMES FOR SATELLITE REPEATER SYSTEMS Ph.D. Thesis
Sanjay Kumar Bose 1980 210 p
Avail: Univ. Microfilms Order No. 8016354

Demand assigned packet radio schemes using satellite repeaters can achieve high capacities but often exhibit relatively large delays under low traffic conditions when compared to random access. Several schemes which improve delay performance at low traffic but which have high capacity are presented and analyzed. These schemes allow random acess attempts by users, who are waiting for channel assignments. The performance of these are considered in the context of a multiple point communication system carrying fixed length messages between geographically distributed (ground) user terminals which are linked via a satellite repeater. Channel assignments are done following a BCC queueing discipline by a (ground) central controller on the basis of requests correctly received over a collision type access channel. In TBACR Scheme A, some of the forward message channels are set aside for random access transmissions; the rest are used in a demand assigned mode. Schemes B and C operate all their forward message channels in a demand assignment mode but, by means of appropriate algorithms for trailer channel selection, allow random access attempts on unassigned channels. The latter scheme also introduces framing and slotting of the time axis to implement a more efficient algorithm for trailer channel selection than the former.
Dissert. Abstr.

N80-27549 California Univ., Los Angeles.
ON THE SPATIAL CAPACITY OF PACKET RADIO NETWORKS Ph.D. Thesis
John Andrew Silvester 1980 153 p
Avail: Univ. Microfilms Order No. 8016042

Point-to-point network can achieve much higher performance levels due to the ability to spatially reuse the channel. Optimum transmission ranges and retransmission policies (maximizing capacity) for various configurations of ALOHA networks are derived. For one dimensional random networks (i.e., random topologies) with random traffic matrices, satisfied by exactly adjusted transmission range, allowing communication in one hop, a capacity proportional to the logarithm of the number of nodes in the network was obtained. For regular (topology) networks using fixed transmission ranges and multi-hop communication to support uniform traffic matrices, a throughput of 2/e was obtained. For two dimensional networks, throughput proportional to the square root of the number of nodes in the network was obtained for both regular and random topologies. The best regular design is a hexagonal tesselation. The optimum average degree for random networks in which each node uses the same (fixed) transmission radius is shown to be about 6. Several routing algorithms are presented and the best performanced. it is shown that the routing algorithm which balances traffic flow, seems to produce the best performance. Dissert. Abstr.

N80-27550 Ohio State Univ., Columbus.
PROTOCOL CONSTRUCTIONS FOR COMMUNICATION NETWORKS Ph.D. Thesis
Yanpyng Albert Teng 1980 277 p
Avail: Univ. Microfilms Order No. 8015929

Various issues in constructing network communication protocols that are correct, modifiable and maintainable are discussed. Specific emphasis is placed on the practical techniques that enable these protocols to be implemented in an effective way and at acceptable cost. A systematic protocol construction methodology using both formal language and software engineering techniques. Dissert. Abstr.

N80-27551 North Carolina Univ. at Chapel Hill.
RADIATION COUPLED DYNAMICS OF RAM CONFINED RADIO SOURCES Ph.D. Thesis
Gary Guy Rolison 1979 90 p
Avail: Univ. Microfilms Order No. 8013987

It is found that internal turbulence generated by coupling between the plasmoid and the external flow, while providing a mechanism for relativistic particle acceleration, causes rapid expansion leading to a decrease in both penetrating power and long term luminosity. However, inclusion of the effects on dynamics of internal energy loss through synchrotron and free-free emission reveals that this energy loss mechanism can dominate the plasmoid's internal energy balance. The resulting plasmoid contraction introduces a new mechanism for the maintenance of relativistic particle energy-compressive work. The scenario in which both compressive work and turbulent particle acceleration occur results in the greatest plasmoid penetration and best long term luminosity maintenance. It is found that a plasmoid which encounters a decreasing background density has an increased tendency to expand, resulting in a lower internal energy and luminosity. Conversely, contraction is favored for plasmoids encountering an increasing background density. Dissert. Abstr.

N80-27552 Cornell Univ., Ithaca, N. Y.
COMMUNICATION OVER A QUANTUM CHANNEL WITH FEEDBACK Ph.D. Thesis
John Edward Kaufmann 1980 183 p
Avail: Univ. Microfilms Order No. 8015693

The use of an ideal feedback channel was investigated in a quantum communication system where coherent signals were used and the transmitter was subject to an average energy constraints. The quantum system corresponding to the optical field arriving at the receiver was assumed to be in a pure state. Binary message sequences were transmitted and the receiver employs a sequential detection strategy where bit-by-bit measurements were made, one corresponding to each symbol of the transmitted sequence. The measurement performed at each step was allowed to change, where the choice was determined by the message source statistics and the previous decisions made by the receiver. The forward channel was assumed to be noise free so that performance was limited only by quantum effects at the receiver. Dissert. Abstr.

N80-27553 Colorado Univ. at Boulder.
THEORETICAL AND EXPERIMENTAL STUDY OF THE CHARACTERISTICS OF A THIN CIRCULAR LOOP ANTENNA ABOVE A HOMOGENEOUS, DISSIPATIVE HALF-SPACE
Ahmed Saad Abulkassem 1980 204 p
Avail: Univ. Microfilms Order No. 8011261

The problem of two parallel, staggered loop antennas of the same radius located in free space was investigated. Current distributions on the two loops were obtained by solving two coupled integral equations simultaneously using the well-known Fourier series expansion technique. It is found that when the separation between the two loops is large compared to the radius of the wire loops, the coupling between the two coaxial resonant loops is generally much stronger than that between two coplanar loops. It is also found that the change in input conductance, which sometimes can be as large as 60 percent of the value of the input conductance of an isolated antenna, occurs usually when the separation of the two coaxial loops are close to integer multiples of wavelength. Proximity effects not only change the overall amplitudes of the currents on the loops, but the distribution of the currents as well. Dissert. Abstr.

N80-27554 Cornell Univ., Ithaca, N. Y.
INFRARED STUDY OF HYDROGEN CHEMISORBED ON W(100) BY SURFACE ELECTROMAGNETIC WAVE SPECTROSCOPY Ph.D. Thesis
Yves Jean Chabal 1980 209 p
Avail: Univ. Microfilms Order No. 8015651

The first high resolution measurements of the v sub 1 vibrational mode of hydrogen chemisorbed on W(100) have been made using an infrared technique. The technique utilized the properties of inhomogeneous surface electromagnetic waves (SEW's) which propagated for several centimeters along a metal surface for wavelengths in the 10 micron region. Two methods for exciting SEW's on a metal surface were investigated. It was found that broadband SEW's could be generated by bombarding the surface with low energy electrons (approximately 100 eV), but the yield was too small to allow spectroscopic studies. A coupling geometry based on the principle of total internal reflection was devised to convert bulk radiation from a laser beam into

SEW's. This edge coupler was shown to be more efficient and more convenient than the usual two prism coupler or the grating coupler. With this coupler, the sensitivity of SEW's to monolayer coverages of molecules on metal surfaces was tested by studying the internal modes of KReO4 and SF6 physisorbed on gold films. Dissert. Abstr.

N80-27555*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FOCAL AXIS RESOLVER FOR OFFSET REFLECTOR ANTENNAS
R. F. Schmidt May 1980 36 p refs
(NASA-TM-80683) Avail: NTIS HC A03/MF A01 CSCL 09C

Described are electrical means for determining the focal axis of an offset reflector antenna whose physical rim is not coincident with the boundary of the electrical aperture. Even and odd sensing functions are employed in the focal region, leading to both amplitude and phase criteria for resolving a focal axis generally inclined with respect to the system axis. The analytical aspects of the problem are discussed, and an example related to a 4-meter Large-Antenna Multiple-Frequency Microwave Radiometer (LAMMR) is included. The technique is useful for focal axis determination in mathematical simulations and in the physical world. Author

N80-27556*# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
COMPUTER PREDICTION OF LARGE REFLECTOR ANTENNA RADIATION PROPERTIES
Alan Botula Jul. 1980 169 p refs
(Grant NsG-1588)
(NASA-CR-163253) Avail: NTIS HC A08/MF A01 CSCL 17I

A FORTRAN program for calculating reflector antenna radiation patterns was rewritten and extended to include reflectors composed of a number of panels. These individual panels must be analytic surfaces. The theoretical foundation for the program is as follows: Geometrical optics techniques are used to trace rays from a feed antenna to the reflector surface and back to a mathematical plane just in front of the reflector. The resulting tangential electric field distribution, assumed to be the only source of forward radiation, is integrated numerically to calculate the radiation pattern for a desired set of angles. When the reflector is composed of more than one panel, each panel is treated as a separated antenna, the ray-tracing procedure and integration being repeated for each panel. The results of the individual aperture plane integrations are stored and summed to yield the relative electric field strength over the angles of interest. An example and several test cases are included to demonstrate the use of the program and verify the new method of computation. A.R.H.

N80-27557*# Clarkson Coll. of Technology, Potsdam, N.Y.
A MICROPROCESSOR BASED HIGH SPEED PACKET SWITCH FOR SATELLITE COMMUNICATIONS Final Report, 15 Apr. 1978 - 30 May 1980
Mohammed Arozullah and Stephen C. Crist 30 May 1980 347 p refs
(Grant NsG-3191)
(NASA-CR-163357) Avail: NTIS HC A15/MF A01 CSCL 17B

The architectures of a single processor, a three processor, and a multiple processor system are described. The hardware circuits, and software routines required for implementing the three and multiple processor designs are presented. A bit-slice microprocessor was designed and microprogrammed. Maximum throughput was calculated for all three designs. Queue theoretic models for these three designs were developed and utilized to obtain analytical expressions for the average waiting times, overall average response times and average queue sizes. From these expressions, graphs were obtained showing the effect on the system performance of a number of design parameters. A.R.H.

N80-27558*# Clarkson Coll. of Technology, Potsdam, N.Y.
A MICROPROCESSOR BASED HIGH SPEED PACKET SWITCH FOR SATELLITE COMMUNICATIONS, EXECUTIVE SUMMARY Executive Summary Report, 15 Apr. 1978 - 30 May 1980
Mohammed Arozullah and Stephen C. Crist 30 May 1980 16 p refs
(Grant NsG-3191)
(NASA-CR-163357) Avail: NTIS HC A02/MF A01 CSCL 17B

The feasibility of using microprocessors to control satellite-borne packet switching was investigated by designing a packet switch architecture suitable for microprocessor control, using 2900 series components to design the processor(s), and evaluating the packet switch in terms of system throughput, delay, and queue sizes without the packet switch. System architecture for one, three, and multiple processors was designed and evaluated. The production cost of the single processor packet switch is estimated at $500,000, excluding cost of development. The three processor version which can support a maximum throughput of 500,000 packets/sec is estimated to have a production cost of under $100,000. For the multiple processor system, cost is believed to be proportional to throughput, with $1,000,000 for 500,000 packets/sec being the proportionality factor. A.R.H.

N80-27559# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INFORMATION PROCESSING TECHNIQUES PROGRAM. VOLUME 1. PACKET SPEECH SYSTEMS TECHNOLOGY Semiannual Technical Summary Report, 1 Apr. - 30 Sep. 1979
Theodore Bially 30 Sep. 1979 40 p refs
(Contract F19628-78-C-0002; ARPA Order 2006)
(AD-A083195; ESD-TR-79-281) Avail: NTIS HC A03/MF A01 CSCL 17/2

The current program has two major thrusts; i.e., the development and refinement of practical low-cost, robust, narrowband and variable-rate speech algorithms and voice terminal structures, and the establishment of an experimental wideband satellite network to serve as a unique facility for the realistic investigation of voice/data networking strategies. This report covers work in the following areas: development of a custom-LSI-based narrowband channel vocoder; studies and real-time implementation of improved vocoder structures and algorithms; evaluation of speech processing capability of CCD-based spectrum analysis hardware; preparation of hardware and firmware for an upcoming speech algorithm test and evaluation program; design and implementation of packet voice terminals and local area access facilities; progress in satellite network and internetted packet voice conferencing and in the development of new packet voice network protocols; and design of a traffic emulation module for the wideband experimental network. GRA

N80-27560# Naval Research Lab., Washington, D. C.
ELECTROMAGNETIC SCATTERING PATTERNS FROM SINUSOIDAL SURFACES: VERTICAL POLARIZATION
R. H. Lang and A. K. Jordan 17 Mar. 1980 18 p refs
(AD-A083919; NRL-MR-4188) Avail: NTIS HC A02/MF A01 CSCL 20/14

In this paper we present an analysis and calculation of scattering patterns resulting from a vertically polarized beam of electromagnetic plane waves incident on a sinusoidal surface. This model is frequently used to study scattering from periodically rough surfaces. The horizontally polarized case is treated in a previous paper by the authors. The vector properties of this electromagnetic scattering problem are considered in this communication by extending the previous analysis to the vertically polarized case and comparing the scattering patterns for the two polarizations. GRA

N80-27561# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FEEDBACK NULLING DEMONSTRATION SYSTEM HARDWARE
David A. Siegel, David M. Hodsdon, Bing M. Potts, Howard S. Babbitt, Ervin S. Davis, Warren K. Hutchinson, and Karen Leeds 23 Nov. 1979 108 p refs
(Contract F19628-80-C-0002; AF Proj. 2029)
(AD-A084013; TN-1979-12; ESD-TR-79-272) Avail: NTIS HC A06/MF A01 CSCL 17/4

As part of the technology development of anti-jam satellite communications, Lincoln Laboratory has developed, built, and tested a demonstration analog-feedback adaptive-nulling antenna

system. The system, which is based on the Howells-Applebaum feedback loop, is designed to increase the signal-to-interference ratio when desired signals operate in the presence of interference signals. The signals received from interfering or undesirable signal sources are minimized by appropriately modifying the antenna radiation pattern so as to attenuate signals from the direction of those sources relative to the desired signals. The demonstration system consists of a simulated array of antenna elements and uplink signals and a real-time adaptive receiver-processor which controls the weighting of each element signal prior to combining. The weighting process involves changing the relative amplitudes and phases of the received signals thus changing the effective receiving radiation pattern of the antenna, i.e., its relative response to signals arriving from different directions. The system operation involves taking the signals from N independent antenna elements and weighting and combining them to form a single output signal in which the signal-to-interference ratio is enhanced over what it is for any individual antenna element. The task of the nulling processor is to select the set of weights for the antenna element array in some optimum fashion. GRA

N80-27562# Magnavox-General Atronics, Philadelphia, Pa.
HIGH POWER HF AND NOISE CANCELLATION SYSTEM Final Technical Report, Oct. 1978 - Jan. 1980
Samuel J. Harris and Stephen J. Rosasco Griffiss AFB, N.Y. RADC Mar. 1980 48 p refs
(Contract F30602-78-C-0338; AF Proj. 2338)
(AD-A084016; GAC-3392-3403-13; RADC-TR-80-56) Avail: NTIS HC A03/MF A01 CSCL 20/14

The objectives of this effort were achieved and should permit high power HF (2-30 MHz) transmitters and conventional HF receivers to be collocated on an aircraft and operated simultaneously (full duplex) with appreciably less than 10% frequency separation between the transmit and receive channels. The option of frequency assignment between the Maximum Usable Frequency (MUF) and the Lowest Usable Frequency (LUF) for the transmit and receive frequencies can result in a 40 dB improvement in a duplex circuit, or stated another way, it may be the only way to establish a circuit between two points. One or more full duplex HF circuits can be operated simultaneously on an aircraft. The technique employed is a high power HF Interference Cancellation System which is adaptive and completely automatic. The significance of this effort is that it has direct application to C3 aircraft and collocated ground HF sites, including those sites with transmitters of ultra high power output (1 kW). In addition, the ultra linear high power weight/controller technology employing goniometers can be applied in any frequency range from VLF to UHF. GRA

N80-27563# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
INTERMEDIATE RESULTS OF THE RADAR BACKSCATTER STUDY OF SEA ICE IN THE BEAUFORT SEA
C. V. Delker, R. G. Onstott, and R. K. Moore Mar. 1980 48 p refs
(Contract N00014-76-C-1105)
(AD-A083644; RSL-TR-331-15) Avail: NTIS HC A03/MF A01 CSCL 08/12

As a part of the Beaufort Sea segment of the Surveillance Satellite Project (SURSAT), a team of investigators from the University of Kansas conducted experiments to obtain quantitative measurements of radar backscatter from sea ice during the month of March 1979. Thick first-year sea ice, thin first-year sea ice, and an inland fresh water lake were studied using a surface-based FM-CW scatterometer that swept from 1.1 - 1.9 GHz and 8.5 - 17.5 GHz with angles of incidence (from vertical) of 10 deg. to 75 deg and various linear polarizations. Measurements of thick first-year sea ice, thin first-year sea ice, brackish sea ice, and an inland fresh-water lake were also made using a helicopter-borne FM-CW scatterometer that swept from 8.5 - 17.5 GHz with incidence angles of 20 deg. to 60 deg. and VV polarization only. The 1.1 - 1.9 GHz measurements show that lake ice can be distinguished from thick and thin first-year sea ice. The radar cross-sections of thick and thin first-year sea ice are not significantly different for incidence angles less than 45 deg. The 8.5 - 17.5 GHz measurements indicate that lake ice can be distinguished from the other types in all cases. Thick and thin first-year sea ice are separated by a 2 - 4 dB difference for incidence angles greater than 40 deg. The effect of snow cover on the return from lake ice was also investigated with dramatic results. GRA

N80-27564# Catholic Univ. of America, Washington, D. C. Dept. of Physics.
RESONANCES OF RADAR TARGETS AND TARGET DISCRIMINATION Final Report, 6 Mar. 1979 - 5 Mar. 1980
Herbert Uberall Mar. 1980 45 p refs
(Contract N00019-79-C-0270)
(AD-A083680) Avail: NTIS HC A03/MF A01 CSCL 17/9

The topic of the research program covers methods for target discrimination by radar scattering, making use of the natural resonances of the targets. The general plan of the program consists in a study of resonances of targets of simple shape (e.g., sphere) but complex composition (e.g., dielectric coating of conductors) during the first year, followed by simple conducting targets and comparison with parallel measurements performed at NSWC Dahlgren in the second year, with further extension to conductors of more complex shapes, using Waterman's methods, later on. The emphasis of our study is two-fold, namely: (1) to study ways how the resonance structure of the radar echo can be used for identifying the nature of the target (the 'inverse scattering problem'); and (2) to obtain a physical understanding of the phenomena that cause the resonances, and how they manifest themselves in both steady-state and pulsed echoes. Such an understanding, in preference to a more mechanical use of the singularity expansion method, will provide us with the true capability of mastering the target discrimination problem. GRA

N80-27565# Army Engineer Topographic Labs., Fort Belvoir, Va.
BACKSCATTERING OF ELECTROMAGNETIC WAVES FROM A LAYER OF VEGETATION
Richard A. Hevenor 15 Feb. 1980 29 p refs
(AD-A083922; ETL-R008) Avail: NTIS HC A03/MF A01 CSCL 17/9

A theoretical model for the backscattering of electromagnetic waves from a layer of vegetation is computed using a first order renormalization technique to determine volume scattering. The vegetation soil interface is assumed rough according to the tangent plane approximation and the scattering from this boundary is added incoherently to the volume scattering result. The mean wave in the vegetation is obtained using a bilocal approximation of the Dyson's equation. A free space dyadic Green's function is used along with a correlation function of the dielectric fluctuations which is exponential in form and which also possess different correlation lengths lx, ly, and lz in the x, y, and z, directions. Effective propagation constants are obtained for both horizontal and vertical polarizations. The scattered wave is solved for using a two dimensional Fourier transform technique and the boundary conditions at either end of the vegetation layer are matched. The far field backscatter coefficients are computed for both horizontal and vertical polarizations. The mean and variance of the dielectric fluctuations are calculated with the aid of Peake's model for the dielectric constant of vegetation. The theory is matched to experimental data taken from a corn field. The resulting values for the correlation parameters are then used to monitor the growth pattern of the corn field over a period of time. Comparison between the theoretical and experimental results over this time period are shown. The theory is also matched to experimental data from spring and fall deciduous trees. GRA

N80-27566# Army Electronics Research and Development Command, Fort Belvoir, Va. Electronics Technology/Devices Lab.
EFFECT OF VARIOUS DIELECTRICS ON THE DESIGN OF MILLIMETER-WAVE LINE SCANNING ANTENNAS
Kenneth L. Klohn Nov. 1979 26 p refs
(DA Proj. 1L1-62705-AH-94)
(AD-A083791; DELET-TR-79-24) Avail: NTIS HC A03/MF A01 CSCL 09/5

The effect of using various materials having different relative dielectric constants on the theoretical design of millimeter-wave

line scanning antennas has been examined. Three typical dielectrics were chosen for comparative purposes; silicon (epsilon(r) = 12, sapphire (epsilon(r) = 9.4), and boron nitride (Epsilon(r) = 4). Theoretical calculations were made for each material over the frequency range of 60 to 220 GHz, with special emphasis at 94 GHz due to its increasing use in new millimeter-wave systems. Comparisons were made among the dielectric materials in regard to their maximum allowable physical size for single E(y) 11 mode operation. Using each of the three dielectrics with periodic surface perturbations as a line scanning antenna, the effects on the angle of radiating energy due to changes in the waveguide size and perturbation spacing were determined and evaluated. GRA

N80-27567# National Aviation Facilities Experimental Center, Atlantic City, N. J.
DEVELOPMENT OF AN AUTOMATED REMOTE COMMUNICATIONS AIR-GROUND (RCAG) MONITORING SYSTEM Final Report, Mar. 1978 - May 1979
Nicholas J. Talotta and Albert J. Rehmann Apr. 1980 192 p refs
(AD-A083754; FAA-NA-79-44; FAA-RD-79-125) Avail: NTIS HC A09/MF A01 CSCL 14/2

A monitoring System for remote communication air-ground (RCAG) facility equipment was developed, including the design and fabrication of an engineering model. Sensor techniques for the transmitters and receivers were investigated. The design made use of a microprocessor with associated hardware and software to 'continuously monitor' critical parameters. Certification data and/or alarms were reported via a terminal. It is concluded that production of automated monitoring equipment for Federal Aviation Administration (FAA) air/ground communication facilities with the specific sensor techniques, processing, and control used in this experimentation is feasible. GRA

N80-27568# Transportation Systems Center, Cambridge, Mass.
THEORETICAL FEASIBILITY OF DIGITAL COMMUNICATION OVER OCEAN AREAS BY HIGH FREQUENCY RADIO Final Report, Aug. 1978 - Jul. 1979
George W. Haydon, Charles M. Rush, and Larry R. Teters Nov. 1979 89 p refs Prepared in cooperation with the National Telecommunication Information Admin., Boulder, Colo.
(AD-A079424; TSC-FAA-79-26; FAA-EM-78-20) Avail: NTIS HC A05/MF A01 CSCL 17/2

The theoretical reliability of digital data transmission via high-frequency radio is examined for typical air traffic routes in the Atlantic and Pacific areas to assist the U.S. Department of Transportation in the evaluation of a system for improving air traffic control over ocean areas. The expected performance of a reference high-frequency data transmission system of 1200 bits per second with a permissible error rate of one in a thousand binary error is expressed as a percentage of time that a given theoretical reliability will be equaled or exceeded. The expected performance of air-to-air HF systems is also considered, and it is concluded that these systems should work for the reference communication system out to the line-of-sight range of about 800 km for high-flying aircraft. GRA

N80-27569# Morgenthaler (Frederick R.), Wellesley, Mass.
THEORETICAL STUDIES OF MICROSTRIP ANTENNAS. VOLUME 2: ANALYSIS AND SYNTHESIS OF MULTI-FREQUENCY ELEMENTS Final Report, Apr. 1978 - Jul. 1979
Frederic R. Morgenthaler Sep. 1979 50 p
(Contract DOT-TSC-15364)
(AD-A075540; TSC-FAA-79-21-2; FAA-EM-79-11-2) Avail: NTIS HC A03/MF A01 CSCL 09/5

Volume 2 of Theoretical Studies of Microstrip Antennas deals with the analysis and synthesis of several types of novel multi-resonant elements with emphasis on dual-frequency operation of rectangular microstrip patch antennas with or without external matching networks. Specifically, we analyze dual resonances created within a single rectangular patch by means of appropriate dielectric loading and also those associated with a patch capacitively-coupled to either a lumped or distributed matching network. In all cases radiation is obtained from slots in the rectangular patch in combination with open-circuited edges. Rather than separately design the dual-resonating elements and matching networks and hope for efficient radiation and proper patterns at both frequencies, we favor and herein pursue an integrated synthesis which demands simultaneous fulfillment of the design goals. A synthesis approach, based upon coupled resonator theory, is also developed and applied to situations in which one resonant element is a rectangular microstrip patch and the second element either a second patch or else a lumped or distributed matching network. Based upon these considerations, several new antenna configurations are proposed that utilize either in line or stacked element geometries. Volume I of this report deals with general design techniques and analyses of single and coupled microstrip radiating elements. GRA

N80-27570# Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.
COMPUTER PROGRAMS FOR ELECTROMAGNETIC TRANSMISSION THROUGH A FILLED SLIT OF ARBITRARY CROSS SECTION IN A CONDUCTING PLANE OF FINITE THICKNESS Progress Report, Nov. 1978 - Jul. 1979
David T. Auckland and Roger F. Harrington Griffiss AFB, N.Y. RADC Mar. 1980 148 p refs
(Contract F30602-79-C-0011; AF Proj. 2338)
(AD-A084352; RADC-TR-80-59) Avail: NTIS HC A07/MF A01 CSCL 09/2

Three computer programs are presented for the analysis of electromagnetic transmission through a filled slit of arbitrary cross section in a conducting plane of finite thickness. The first and second programs utilize a non-modal and modal formulation, respectively, which are derived in detail in an earlier report. Some approximate solutions are available when the slit cross section is a rectangular shape and these are investigated in the third program. The programs are all written in FORTRAN IV language. Quantities computed are equivalent electric and magnetic currents on the contour defining the slit cross section, transmission coefficients, gain patterns, and normalized field patterns. Sample input and output data are presented for each program. Detailed instructions concerning the use of each program and its capabilities are given. GRA

N80-27571# SRI International Corp., Menlo Park, Calif.
GRADIENT SCATTERING THEORY DEMONSTRATES THAT VHF, SPREAD-F RADAR BACKSCATTER REVEALS STREAMING INSTABILITIES Progress Report, Jan. - Oct. 1978
Walter G. Chesnut 30 Nov. 1978 53 p refs
(Contract DNA001-78-C-0075)
(AD-A084644; AD-E300761; DNA-4801) Avail: NTIS HC A04/MF A01 CSCL 17/9

Field-aligned radar backscatter echoes have been obtained from the equatorial F region using frequencies from slightly above the plasma frequency to as high as 415 MHz. In this report we study the possibility that such echoes result from steep transitions from low- to high-density plasmas. We have studied four profile forms for this transition. The first, the only physically based profile, is assumed to be associated with the gyroradius distribution of the ions in the plasma. The second profile, the Epstein profile, is subject to exact reflectivity analysis and is used to provide guidance concerning the accuracy of the Born approximation used in our other calculations. The third profile, a half Gaussian wedded to a step function, a form used by Balsley and Farley, and a fourth profile, a raised cosine form, lead to very intense scattering, by hundreds of dBs, compared with that derived from our physically based gyroradius distribution. We believe we have shown that the intense scattering results computed by Balsley and Farley are due to mathematical discontinuities in the second derivatives of these last two profiles. As a result, we argue that the half-Gaussian profile is an inappropriate, unphysical model, and results based upon this model are probably unrealistic. GRA

N80-27572# Physical Dynamics, Inc., Bellvue, Wash.
STATISTICAL BEHAVIOR OF SIGNALS FROM THE WIDEBAND SIGNAL Final Report, 15 Nov. 1977 - 31 Dec. 1978
Edward J. Fremouw 31 Dec. 1978 59 p refs
(Contract DNA001-78-C-0042)
(AD-A084646; AD-E300759; PD-NW-79-193R; DNA-4818f) Avail: NTIS HC A04/MF A01 CSCL 20/14

Optical and radio signals that have been scattered by random

refractive-index structure must be described statistically in systems-oriented codes and other applications. The general nature of the statistics that would best describe such signals has been an open question for some time, with different models being used close to the medium (log-normal) and far from it (Rician). Signal behavior in the intermediate zone, which is the relevant distance regime for radiowave communication through the structured ionosphere and through striated, high-altitude nuclear plasmas, has been difficult to characterize in a general and systematic way. The Wideband satellite experiment, with its multiple, coherent frequencies and its variety of observing geometries, has provided a wealth of data upon which to base a general model. In this work, careful and detailed analysis has been performed of VHF, UHF, and L-band data from the Wideband receiving stations at Ancon, Kwajalein, Stanford, and Poker Flat to establish the statistical behavior of scattered signals over a wide range of scattering strength, Fresnel-zone size (which sets the effective distance), and scattering geometry. Histograms of intensity and phase were compared, by means of chi-square testing, with probability density functions derived from four leading signal-statistical hypotheses: log-normal; generalized Gaussian, of which Rice statistics are a special case; two-component, which invokes the log-normal and generalized Gaussian hypotheses in different regimes of the signal fluctuation spectrum; and Nakagami-m, which is an approximation to generalized Gaussian statistics addressing only the behavior of signal intensity. GRA

N80-27573# Ohio State Univ., Columbus.
RADIATION BY SOURCES ON PERFECTLY CONDUCTING CONVEX CYLINDERS WITH AN IMPEDANCE SURFACE PATCH
L. Ersoy and P. H. Pathak Griffiss AFB, N.Y. RADC Jan. 1980 129 p refs
(Contract F19628-77-C-0107; AF Proj. 2305)
(AD-A084345; ESL-784641-2) Avail: NTIS HC A07/MF A01 CSCL 20/14

This report deals with an asymptotic high frequency analysis of the radiation patterns of a magnetic line source, or a magnetic line dipole, located on a uniform impedance surface patch which partly covers an electrically large perfectly conducting convex cylinder. This work is relevant, for example, to the analysis of fuselage mounted airborne antennas for satellite communication purposes. In the latter application impedance surface patches may be employed to increase the radiation intensity near the horizon over that which would ordinarily exist in the absence of any such impedance loading. In the present analysis, the impedance surface patch is represented as an equivalent aperture in the rest of the perfectly conducting convex cylinder. Approximate asymptotic expressions for the (equivalent aperture distribution); i.e., for the (currents on the impedance surface patch) are developed in this work for the two source types; these expressions for the currents are valid in the neighborhood of the source. The radiation pattern of this configuration is then found in a straightforward manner by numerically integrating this current distribution in conjunction with a simple and accurate asymptotic high frequency form of the perfectly conducting, convex cylinder Green's function. Radiation pattern calculations based on this analysis are found to compare quite well with a numerical moment method type solution, a previous GTD solution for those impedances which support an Elliot mode, and also with some presently available experimental results. GRA

N80-27574# Ohio State Univ., Columbus. ElectroScience Lab.
BROADBAND METALLIC RADOME Interim Report, Jan. 1976 - Sep. 1979
J. S. Ernst Wright-Patterson AFB, Ohio AFAL Sep. 1979 121 p refs
(Contract F33615-76-C-1024; AF Proj. 7633)
(AD-A084663; ESL-784346-11; AFAL-TR-79-1142) Avail: NTIS HC A06/MF A01 CSCL 09/5

This report studies the transmission properties of metallic radome configuration of two slot arrays consisting of three-legged elements imbedded in three dielectric layers. The purpose is to design a bandpass filter with as large a bandwidth as possible while still maintaining a constant bandwidth for all angles of incidence. GRA

N80-27575# Science Applications, Inc., Tucson, Ariz.
RADAR TEST RANGE DESIGN CONSIDERATIONS Final Report
Dino Sofianos 29 Apr. 1980 83 p refs
(Contract F33657-79-C-0178)
(AD-A084400; SAI-TR-04-165-3) Avail: NTIS HC A05/MF A01 CSCL 17/4

This report presents considerations for and the preliminary design of a synthetic aperture RADAR (SAR) test range. The purpose is to present a methodology and conceptual design for a Flexible Test Bed (FTB) digital processor operational test. The objectives of this operational test are to: (1) determine whether the processor modifications improved image quality, (2) establish a processor performance baseline, and (3) determine whether the system will attain desired levels of probability of detection. It is assumed that SAI would develop a test design while GAC will fabricate and install the required radar test range. GRA

N80-27576# Ohio State Univ., Columbus. ElectroScience Lab.
COMMUNICATION APPLICATION OF ADAPTIVE ARRAYS Final Report
R. T. Compton, Jr. Mar. 1980 8 p ref
(Contract N00019-79-C-0291)
(AD-A084402; ESL-771847-7) Avail: NTIS HC A02/MF A01 CSCL 17/2

There are three areas of work under this contract. The first involves studies on weight jitter and dynamic range for the improved LMS loop. The second is a continuation of research on a reference signal generation technique for FSK signals. The third area involves the preparation of a monograph on adaptive arrays. GRA

N80-27577# Naval Postgraduate School, Monterey, Calif.
VOICE TRANSMISSION AT 6000 BITS PER SECOND USING DELTA MODULATION M.S. Thesis
Elias Emmanuel Padouvas Dec. 1979 36 p refs
(AD-A084375) Avail: NTIS HC A03/MF A01 CSCL 17/2

Digital systems are of major importance in modern communications. This research investigates the minimum clock (bit) rate of a commercially available delta modulator/demodulator needed to transmit intelligible voice signals. Intelligible voice and music signals were recovered using a clock rate as low as 6 Kbits/sec. GRA

N80-27578# Naval Postgraduate School, Monterey, Calif.
COMPARISON OF AN ALPHA-BETA AND KALMAN FILTER IN TRACK WHILE SCAN RADARS M.S. Thesis
Dimitrios Emmanuel Mayiatis Dec. 1979 153 p refs
(AD-A084464) Avail: NTIS HC A08/MF A01 CSCL 17/9

The efficient use of a search-surface radar or sonar, in which one or more targets appear on the screen intermittently usually demands a device for tracking the targets automatically. Such a device, called a track while scan system, must make an estimate of each target's instantaneous position from the sampled-data information provided by the radar. For this purpose, an alpha-beta filter and an optimal Kalman filter, that must track maneuvering targets, are analyzed here and compared in terms of tracking accuracy for tactical application. GRA

N80-27579# Naval Postgraduate School, Monterey, Calif.
BACKGROUND MONITOR FOR THE SATCOM SIGNAL ANALYZER M.S. Thesis
Heinz-Joachim Niemann Dec. 1979 201 p refs
(AD-A084381) Avail: NTIS HC A10/MF A01 CSCL 09/2

A SATCOM Signal Analyzer (SSA) is being developed by the Satellite Communications Laboratory of the Naval Postgraduate School. The purpose of this system is to provide high-speed multi-channel digital spectrum analysis and characterization of the outputs of UHF communication satellite transponders while in orbit and operating. A Digital Computer Subsystem provides the control for most of the equipment in the system. The thesis documents a portion of the software development for this subsystem. This software performs all operator interaction using a Touch Input System and a Graphics Display. It is controlled to a large extent by menu data stored in a disc file, which can easily be extended or modified. Non-trivial file management and

concurrent processing of several functions are major characteristics of this software. GRA

N80-27580# Mississippi Univ., University.
ELECTROMAGNETIC SCATTERING BY SURFACES OF ARBITRARY SHAPE
Donald R. Wilton, S. S. M. Rao, and Allen W. Glisson Griffiss AFB, N.Y. RADC Mar. 1980 69 p refs
(Contract F30602-78-C-0148; AF Proj. 2338)
(AD-A084347; RADC-TR-79-325) Avail: NTIS HC A04/MF A01 CSCL 20/14

The electric field integral equation (EFIE) is used with the moment method to develop a simple and efficient numerical procedure for treating problems of scattering by arbitrarily-shaped objects. The objects are modeled for numerical purposes by planar triangular surface patch models. Because the EFIE formulation is used, the procedure is applicable to both open and closed bodies. Crucial to the formulation is the development of a set of special subdomain basis functions defined on pairs of adjacent triangular patches. The basis functions yield a current representation which is free of line or point charges at subdomain boundaries. A second approach using the magnetic field integral equation (MFIE) and employing the same basis functions is also developed. Although the MFIE applies only to closed bodies, the moment matrix of the MFIE is also needed in dielectric scattering problems and in the so-called combined field integral equation used to eliminate difficulties with internal resonances present in the MFIE and EFIE formulations. The EFIE approach is applied to the scattering problems of plane wave illumination of a flat square plate, a bent square plate, a circular disk, and a sphere. Comparisons of surface current densities are made with previous computations or exact formulations and good agreement is obtained in each case. The MFIE approach is also applied to the sphere and reasonable agreement with exact calculations is obtained. GRA

N80-27581# Martin Marietta Aerospace, Denver, Colo.
ADAPTIVE TECHNIQUES FOR LARGE SPACE APERTURES Final Technical Report, 6 Nov. 1978 - 5 Nov. 1979
R. J. Richardson, John Coyner, Alan Fenn, and Al Brook Griffiss AFB, N.Y. RADC Mar. 1980 329 p refs
(Contract F30602-79-C-0017; AF Proj. 4506)
(AD-A084631; RADC-TR-80-52) Avail: NTIS HC A15/MF A01 CSCL 17/9

Two missions which utilize large space apertures were considered on the program. These were the space-based radar mission (SBR) and the space-based millimeter-wave radiometer mission (MWR). The greater part of the effort was spent on the radar mission. The intent of the program was to investigate reflector-based alternates to the space-fed phased array system that is the current baseline for the space-based radar program. The three major tasks on the program were Task 1, Concept Development/Assessment; Task 2, Performance Analysis, Selected Approach; and Task 3, Specific Mission Designs. The adaptive techniques of interest were those that might be required to compensate for surface irregularities in the large, space-deployable reflectors that would be required for these missions. This and other system requirements were considered in selecting an antenna system for each mission. GRA

N80-27582# Lockheed Missiles and Space Co., Palo Alto, Calif.
SAR OBJECT CHANGES DETECTION STUDY Final Technical Report, 29 Sep. 1978 - 15 Jun. 1979
Kalyan Dutta and Charles D. Kuglin Griffiss, AFB. N.Y. RADC Mar. 1980 58 p refs
(Contract F30602-78-C-0347; AF Proj. 4594)
(AD-A084630; LMSC/D676644; RADC-TR-80-69) Avail: NTIS HC A04/MF A01 CSCL 17/9

This study assessed the applicability of three area-based change-detection algorithms to the problem of recognizing differences between two images. These approaches are based on defining sets of descriptors for small regions of each scene and then comparing these sets of descriptors to indicate areas of change. The first algorithm is based on the phase-correlation concept, a technique for extracting accurate estimates of the relative displacement of two images from the phase of their cross-power spectrum. The 2nd is based on using a subset of power-spectral coefficients for each image; the subset is chosen to minimize differences due to scene bias, shading, or high-frequency noise content. The 3rd is based on defining image moments and a set of functions of these moments which are invariant with respect to a number of geometrical distortion or scale changes of the image. These algorithms were applied to furnished SAR images. Results of the three algorithms are consistent among themselves but correlate weakly with known ground truth. Studies to determine the size of targets that can be reliably detected by use of these methods indicate that the size of targets in the furnished images fails to meet the size criterion for reliable change detection. It is concluded that, for imagery of this quality and resolution, target detection and association algorithms should prove to be more effective for change detection. GRA

N80-27583# General Electric Co., Santa Barbara, Calif.
LORAN-C SIGNAL ANALYSIS PROPAGATION MODEL EVALUATION Final Report, Jun. 1977 - May 1978
Burt Gambill and Kenneth Schwartz Jul. 1979 228 p refs
(Contract DOT-CG-64810-A)
(AD-A084338; GE78TMP-51; USCG-D-20-80) Avail: NTIS HC A11/MF A01 CSCL 20/14

This report compares predictions of groundwave propagation time with experimental values. The prediction methods included an integral equation technique that accounts for both terrain and impedance variations, a method developed by J.R. Wait that accounts for impedance variations, and Millington's or Pressey's technique that accounts for inhomogeneous impedance. Experimental incremental time-of-arrival data were acquired between eight sites along a propagation path from Search-light, NV. to Ft. Cronkhite (near San Francisco Bay). The major conclusions reached from the analysis and comparison of results are: terrain variations produce significant local and cumulative phase variations, in this case, a cumulative large increase in total secondary phase; impedance values need to be known to within less than a factor of two to be sufficient for preparing charts for navigation in restricted waterways; a priori definition of terrain variation can be performed with required accuracy - a priori definition of surface impedance values with sufficient accuracy is unlikely without supporting measurements; and a combination of predictions and measurements is required for accurate chart preparation. Predictions can be used to define appropriate measurement locations and to interpolate between measurement values. GRA

N80-27584# Communications Research Centre, Ottawa (Ontario). Radio and Radar Research Branch.
HF DIRECTION FINDING BY WATERFRONT TESTING
D. W. Rice Mar. 1980 47 p refs
(AD-A084549; CRC-1333) Avail: NTIS HC A03/MF A01 CSCL 17/3

Calculations are reported of the probability of observation of various degrees of phase-front non-linearity for two and three signals incident from different directions upon a phase-measuring array. It is assumed that the signals fade independently, and that their amplitude probability densities are described by a Rayleigh law. It is shown that, under the worst-case conditions of equal powers in the signals, the probability of observing an rms phase deviation of 25 degrees or less from the best-fit straight line to the phase along an array, is about 0.5 when 2 rays are present, and about 0.2 when 3 rays are present. Experimental measurements over a 911km mid-latitude path and a 2100km trans-auroral-zone path, confirm the general behavior predicted by the theory. It is well known that amplitude fading can be attributed to various ionospheric effects; however the measurements show that modulation imposed on the signal at the transmitter can also play an important part in decorrelating the amplitudes of signals received (after different time delays) via different ionospheric modes. In the latter case, the modulation can markedly reduce both the waiting time between phase-linear events, and their duration. The experimental program included concurrent measurements over the same path using FMCW, CW and SSB signals from a co-operative transmission. GRA

N80-27585# Army Missile Command, Redstone Arsenal, Ala. Advanced Sensors Directorate.
QUIET RADAR PROCESSOR ANALYSIS BY COVARIANCE MATRIX TRANSFORMATIONS

Neal B. Lawrence Oct. 1979 53 p refs
(AD-A084453; DRSMI/RE-80-4) Avail: NTIS
HC A04/MF A01 CSCL 17/9

The MICOM Quiet Radar program is a multi-year exploratory development effort to build and test a short-range air-defense system radar with Anti-Radiation Missile (ARM) immunity. By transmitting a low-power, bi-phase modulated, continuous-wave waveform in conjunction with ultra-low sidelobes antenna and a frequency-agile carrier frequency, it is possible to reduce ARM lock-on capabilities to ineffective ranges. The objective of this effort was to determine probability of detection for a given false alarm rate for a candidate Quiet Radar processor by performing covariance matrix transformations. The analysis included range cell averaging CFAR. Results were obtained for two possible configurations of the Quiet Radar processor. The results are given as plots where the probability of detection in each frequency cell is shown for various probabilities of false alarm and CFAR range cell window widths. The analysis has verified previously determined CFAR losses and shown that processor performance is dependent on the low pass filter used for noise reduction. GRA

N80-27586# Arizona Univ., Tucson. Engineering Experiment Station.
EXTERIOR-INTERIOR APERTURE COUPLING OF A RECTANGULAR CAVITY WITH WIRE OBSTACLE Final Technical Report, 30 Aug. 1979 - 31 Jan. 1980
William Arthur Johnson 31 Mar. 1980 73 p refs
(Grant AF-AFOSR-3462-77; AF Proj. 2301)
(AD-A084258; AFOSR-80-0413TR) Avail: NTIS
HC A04/MF A01 CSCL 20/14

In this work, the exterior-interior coupling problem of a cavity backed aperture in a perfectly conducting infinite sheet is considered. The cavity is assumed to be rectangular and contains a perfectly conducting obstacle. For numerical considerations the obstacle is taken to be a straight, thin wire, oriented perpendicular to one of the cavity walls. The problem is formulated in the frequency domain with an e(to the i omega tau power) time dependence. The dyadic formulation of this vector electromagnetic boundary value problem is given. The controversy over the longitudinal wave functions and their contribution to field dyads is resolved. Specific attention is given to the singularities and completeness of the Green's dyads: eigenfunction expansions. Numerically tractable integral equations for the aperture electric fields and the wire currents are obtained. A summation method is developed for evaluation of otherwise slowly converging eigenfunction expansions of potentials dyads when source and observation points become close. The numerical reduction of the integral equations by the method of moments is described. The numerical results for the aperture fields and the wire currents disclose a minus sign discrepancy between the results and previous results of Seidel. A discussion is given which supports the sign in the present work. GRA

N80-27587# Applied Science Associates, Inc., Apex, N. C.
AN ANALYTICAL STUDY OF WAVE PROPAGATION THROUGH FOLIAGE Final Technical Report, 9. Sep. 1978 - 30 Sep. 1979
Gary S. Brown and William J. Curry Griffiss AFB, N.Y. RADC Jan. 1980 213 p refs
(Contract F19628-78-C-0159; AF Proj. 4600)
(AD-A084348; ASA-79(AF)-1; RADC-TR-79-359) Avail: NTIS
HC A10/MF A01 CSCL 20/14

A model is developed for the effect of foliage on the average or coherent field propagating in the foliage and parallel to the foliage-air or foliage-ground interfaces. The model is based upon a number of assumptions which considerably reduce its complexity to the point where it can be used by systems designers in evaluating the effect of foliage on Synthetic Aperture Radars operating near grazing incidence. The model is hypothesized to be valid in the frequency range of about 0.1 to 1.5 GHz for deciduous trees and from 0.1 to about 3 GHz for needle bearing trees. Comparisons with available measurements indicate a surprisingly high degree of agreement considering the simplicity of the model. Suggestions for future analytical and experimental efforts are presented. GRA

N80-27588# Aerodyne Research, Inc., Bedford, Mass.
A STUDY OF REAL TIME SIGNAL PROCESSING METHODS FOR DECODING SPREAD SPECTRUM SYSTEMS Final Report
H. J. Caulfield, Robert Haimes, and Peter Mueller Griffiss AFB, N.Y. RADC Feb. 1980 41 p refs
(Contract F19628-79-C-0032; AF Proj. 4600)
(AD-A084349; RADC-TR-80-24) Avail: NTIS
HC A03/MF A01 CSCL 09/4

Spread spectrum signals require several kinds of processing. First, the effects of tracking error, Doppler shifts, etc. must be compensated out or ignored in some clever way to give the 'raw' signal. Second, the raw signal at high bandwidth must be decoded to give the low bandwidth information stream. Often this requires comparison of the raw signal with a properly synchronized pseudo random reference signal. Third, the low bandwidth signal may or may not be burst error correction coded and hence require appropriate decoding. In this study we found that all three steps in spread spectrum decoding could be approached optically. Specific, stand-alone developments from this program were two in number. First we developed a 'generalized matched filter' which can be used just as a matched filter but which out performs the matched filter in several important ways. Second, we developed a way of obtaining a high spectral resolution tunable acousto-optic filter using existing components. Both developments should find wide application outside spread spectrum decoding. GRA

N80-27589# Lister Hill National Center for Biomedical Communications, Bethesda, Md.
DIGITAL TRANSMISSION EXPERIMENT OVER CTS (COMMUNICATION TECHNOLOGY SATELLITE) AUDIO CHANNELS Final Report
Samuel Yep and Surachai Suthasinekul Jul. 1979 70 p refs
(PB80-159544; LHNCBC-79-14) Avail: NTIS
HC A04/MF A01 CSCL 17B

An experiment is reported involving digital data transmission over a PHS/CTS (Public Health Service/Communications Technology Satellite) audio baseband channel. Since it is desired to evaluate the performance of the existing system from a digital data transmission standpoint, the interface between the digital subsystem and the audio channel is made at the baseband, thereby avoiding major modifications of the existing facilities. A two-level polar baseband signalling technique is employed which, besides being simple to implement, provides the flexibility for experimenting with various data rates. Experimental results indicate that digital transmission with a bandwidth efficiency of 2 bits per cycle for a 0.0001 bit error rate requires an S/N of about 13 dB, approximately 2 dB higher than the theoretical requirement. Possible causes for the degradation are suggested. It is recognized that since the S/N available in the audio baseband channel is much higher than 13 dB, this excess S/N could be exploited by using a multilevel technique to achieve a higher bandwidth efficiency or equivalently, a higher data rate. GRA

N80-27590# Institute for Telecommunication Sciences, Boulder, Colo.
SHARING OF THE BAND 12.2-12.7 GHz BETWEEN THE BRAODCASTING-SATELLITE AND FIXED SERVICES
Hiroshi Akima Jan. 1980 45 p ref
(PB80-157423; NTIA/REPORT-80-32) Avail: NTIS
HC A03/MF A01 CSCL 17B

The United States Administration has proposed for the 1979 WARC (World Administrative Radio Conference) to move the BSS (Broadcasting-Satellite Service) in ITU (International Telecommunication Union) Region 2 from the band 11.7-12.2 GHz to the band 12.2-12.7 GHz, which is also allocated to the terrestrial FS (fixed service). This report discusses the potential of sharing between the BSS and the FS in the band 12.2-12.7 GHz. It is concluded that sharing is feasible under certain conditions. GRA

N80-27591# National Telecommunication Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
HF (HIGH-FREQUENCY) RADIO NOISE IN THE TOPSIDE IONOSPHERE
Charles M. Rush, Rayner K. Rosich, and Carlene Mellecker Feb. 1980 60 p refs Sponsored in part by AFGL

(PB80-162670; NTIA/REPORT-80-33) Avail: NTIS HC A04/MF A01 CSCL 17B

The results of studies undertaken in order to develop a morphological picture of the radio environment in the ionosphere above the peak of the F2 region are discussed. The factors and assumptions that must be considered in assessing the propagation of terrestrially based signals through the ionosphere to satellite heights are summarized. Some general characteristics of the DMSP HF receiver are also given. R.C.T.

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-27592 Purdue Univ., Lafayette, Ind.
THE THEORY AND EFFECTS OF NEGLECTING STATOR AND NETWORK TRANSIENTS Ph.D. Thesis
Timothy Lyall Skvarenina 1979 154 p
Avail: Univ. Microfilms Order No. 8015519

The reduced order linearized equations of the induction machine are derived. Analytical results are developed to show that a ratio of machine parameters may be used as an indication of the accuracy of the eigenvalues predicted by the reduced order model. Large excursion studies of induction machines are presented and the accuracy of the results is shown to be dependent upon the machine parameters and type of study when the stator transients are neglected. Results are presented which show that it is not generally acceptable to neglect the stator and network transients when turbine generator shaft torques are of interest. It is shown that the magnitude of shaft torques resulting from faults in the system is very dependent upon the impedance between the machine and the point of the fault. A method is developed to allow the use of a modified standard transient stability program for the calculation of shaft torques.
Dissert. Abstr.

N80-27593 California Inst. of Tech., Pasadena.
THE HOMOGENEOUS MACHINE Ph.D. Thesis
Bartholomew Nicholas Locanthi 1980 142 p
Avail: Univ. Microfilms Order No. 8016368

The problem of orchestrating many computing elements in the performance of general purpose computations is addressed. A scheme which automatically detects and exploits concurrencies in computations expressed in an applicative subset of the USP programming language is suggested. The mapping of numerical and symbolic computations onto array and tree structures is also described. The design of multiprocessor systems as a problem in bandwidth reduction is evaluated and the concept of a multi level cache is introduced. Dissert. Abstr.

N80-27594 Washington Univ., Seattle.
MODELING AND ANALYSIS OF SWITCHED INTERCONNECTION NETWORKS Ph.D. Thesis
Petre Nichifor Turcu 1979 108 p
Avail: Univ. Microfilms Order No. 8012201

A traffic flow model was developed for the analysis of interconnection networks used in a circuit switched communications system. Using this model, rectangular banyan networks are analyzed. It is shown that, considering the number of component switches, rectangular banyan networks have a relatively large number of paths available to satisfy requests for communication. A graphical technique, is introduced to describe the synthesis and growth of balanced banyan networks for large traffic flows. This technique also provides insight into the size of the area and the number of levels necessary for two-dimensional implementations of balanced banyan networks. A two-dimensional implementation model for networks built out of 2 input, 2 output ports switches was developed and used to characterize the area occupied by crossbar and rectangular banyan networks when realized as VLSI circuits. The area occupied by these networks and the traffic flow values under one-to-one request functions are synthesized in an overall performance measure which allows us to compare crossbar networks and rectangular banyan networks. It is shown that for conservative designs crossbar networks are preferable to rectangular banyan networks. Dissert. Abstr.

N80-27595 Cornell Univ., Ithaca, N. Y.
TRANSIENT STABILITY ANALYSIS OF ac-dc POWER SYSTEMS Ph.D. Thesis
Asrat Teshome 1980 155 p
Avail: Univ. Microfilms Order No. 8015744

A non-linear model of a combined high-voltage ac-dc power system was digitally simulated. The model is used for the study and prediction of the effects of transient interactions between a high-voltage-direct-current (HVDC) transmission line and turbine-generator-shaft torsional behavior when the system is subjected to large disturbances. Improvement of a-c line loadability due to the stabilizing influence of a HVDC link was also examined. Turbine-generator torsional interaction studies were based on subsynchronous phenomena requiring an evaluation of the frequency, magnitude and decay of the subsynchronous currents in the ac-dc system following major system disturbances. The complex waveform of subsynchronous current, obtained by digital simulation, was analyzed using the Fast Fourier Transform technique. Results demonstrate that a HVDC link can affect the incidence of turbine-generator torsionals, can significantly improve the stability of the system in general and can be used to effect increased loadability of the a-c lines. Dissert. Abstr.

N80-27596 Purdue Univ., Lafayette, Ind.
PARTICLE SIZE EFFECTS ON ELECTRICAL PROPERTIES OF THICK FILM RESISTORS Ph.D. Thesis
Ching-Tzuen Tarn 1979 155 p
Avail: Univ. Microfilms Order No. 8015527

Resistors were made with varying combinations of glass and RuO2 particle sizes at varying weight percents of RuO2. Spherical glass particles were used in order to eliminate any possible particle shape defect. The sizes of glass and RuO2 powders were determined with the scanning electron microscope and nitrogen adsorption surface area measurement. In making resistors, special care was taken to throughly blend the resistor pastes so that the blending factor was removed or reduced to a minimum. Different firing temperatures and times were used to fire resistors in an attempt to find a single firing condition that would make all resistors in their optimum sintered regions where optimum conducting chains were formed. The optimum single firing condition could not be found, and compromise conditions were chosen. Resistivities and temperature coefficients of resistance were measured, blending curves were plotted, and the critical conductive volume percents V sub mc's were obtained for plots of log G vs. log (V sub m-V sub mc)(G and V sub m being the conductivity and conductive volume percent respectively).
Dissert. Abstr.

N80-27597 California Univ., Los Angeles.
MUTUAL COUPLING BETWEEN DIPOLES AND SLOTS IN THE PRESENCE OF GROUNDED DIELECTRIC SLABS Ph.D. Thesis
Isaac Khan Tasinga 1980 166 p
Avail: Univ. Microfilms Order No. 8016053

The mutual impedance between slender microstrip dipoles and the mutual admittance between narrow slots which are covered by a dielectric layer are calculated by using a combination of analytical and numerical methods. The basis of the analysis is a conformal transformation which facilitates function theoretic manipulations in the complex plane. This analysis leads to the determination of an integration path along which Sommerfeld integrals converge exponentially. The limits of applicability of this method are discussed. Results for different dielectric materials and substrate thicknesses for known resonant lengths are presented, and are in good agreement with results from other formulations. Results of mutual admittance calculations are presented for narrow slots. These computations are very efficient and are useful in the design of antenna arrays. Dissert. Abstr.

N80-27598 California Univ., Berkeley.
STOCHASTIC INTEGRATION, MARKOV PROPERTY AND MEASURE TRANSFORMATION OF RANDOM FIELDS

Ph.D. Thesis
Bruce Edward Hajek 1979 89 p
Avail: Univ. Microfilms Order No. 8014716

Classes of continuous parameter random fields with Markov properties or stochastic integral representations and random fields arising by absolutely continuous measure transformation were identified and studied. Specific emphasis is given to the central role of Markov properties, innovation representations, and measure transformations in nonlinear recursive estimation for multiple parameter random processes. Dissert. Abstr.

N80-27599 Purdue Univ., Lafayette, Ind.
ANALYSIS AND MODELLING OF A CURRENT-FED FORCE-COMMUTATED POWER CONVERTER Ph.D. Thesis
Samir Sayed Abd-El-Hamid 1979 124 p
Avail: Univ. Microfilms Order No. 8015416

A simplified current fed force commutated converter model was developed and investigated. The simplified model was a quasisteady state representation based on an average value and fundamental frequency formulation of the circuit equations. The simplified converter model was first used to develop an analytical model for a rectifier/current source inverter induction motor drive. The simplified converter model was also used to develop a simplified model of a force commutated inductor converter unit. Dissert. Abstr.

N80-27600 California Univ., Berkeley.
ELECTRON ENERGY DISSIPATION IN LAYERED MEDIA Ph.D. Thesis
Ilesanmi Adesida 1979 137 p
Avail: Univ. Microfilms Order No. 8014594

The influence of electron scattering on the resolution of electron beam lithography was studied theoretically and experimentally. Theoretical calculations of the spatial disruption of electron energy dissipation in a very thin electron sensitive polymer film coated on various thicknesses of silicon substrates have been made using two different Monte Carlo models. Experimentally, elementary lithographic patterns on the layered structures mentioned above. Both theory and experiment showed that higher resolution in electron beam lithography can be achieved by using thinner electron sensitive polymer films, higher voltages, and thinner substrates. Dissert. Abstr.

N80-27601*# Texas Instruments, Inc., Dallas.
IC KU-BAND IMPATT AMPLIFIER Final Report, 1 Jun. 1977 - 31 Jan. 1979
V. Sokolov, M. R. Namordi, F. H. Doerbeck, and W. R. Wisseman Mar. 1979 111 p refs
(Contract NAS5-24182)
(NASA-CR-160004) Avail: NTIS HC A06/MF A01 CSCL 09A

High efficiency GaAs low-high-low IMPATTs were investigated. Theoretical analyses were employed to establish a design window for the material parameters to maximize microwave performance. Single mesa devices yielded typically 2 to 3 W with 16 to 23% efficiency in waveguide oscillator test circuits. IMPATTs with high reliability Pt/TiW/Pt/Au metallizations were subjected to temperature stress, non-rf bias-temperature stress, and rf bias-temperature stress. Assuming that temperature is the driving force behind the dominant failure mechanism, a mean-time-to-failure considerably greater than 500,000 hours is indicated by the stress tests. A 15 GHz, 4W, 56 dB gain microstrip amplifier was realized using GaAs FETs and IMPATTs. Power combining using a 3 db Lange coupler is employed in the power output stage having an intrinsic power-added efficiency of 15.7%. Overall dc-to-rf efficiency of the amplifier is 10.8%. The amplifier has greater than a 250 MHz, 1 db bandwidth; operates over the 0 deg to 50 C (base plate) temperature range with less than 0.5 db change in the power output; weighs 444 grams; and has a volume of 220 cu cm. A.R.H.

N80-27602# Defence Research Establishment, Ottawa. (Ontario). Electromagnetics Section.
NON-LINEAR JUNCTION CHARACTERIZATION
Myles R. McMillan May 1979 53 p refs In ENGLISH; FRENCH summary
(AD-A083898; DREO-TN-79-7) Avail: NTIS HC A04/MF A01 CSCL 09/1

The phenomena of non-linear junctions formed by contacting metal surfaces was investigated and a method to characterize these junctions is described. Normally linear components, such as points of contact, can become nonlinear elements. These can occur in coupling hardware of coaxial transmission lines, in flanged joints of wave guides and in other waveguide components that are bolted together. Chemical compounds build up on metal contact surfaces exposed to the atmosphere. The compounds, oxides and sulphides for example, are semiconductive and tend to increase contact resistance. They have a non-linear current-voltage characteristic that can be used to characterize Metal-Oxide-Metal junctions by non-linear measurements. When a pure sinusoidal current flows through a component (point of contact) the voltage across it is distorted by any nonlinearities present. The distorted voltage can be considered the sum of a fundamental frequency voltage and a number of voltages at harmonic frequencies. The magnitude of these harmonic voltages can serve as a measure of the nonlinearity present in the contact. For convenience, the third harmonic is usually chosen since it has the largest magnitude and therefore is easiest to measure. GRA

N80-27603# Defence Research Establishment, Ottawa. (Ontario). Radar ESM Section.
A COMPREHENSIVE REVIEW OF TRAVELLING WAVE TUBE TECHNOLOGY
Robert Luiz Nov. 1979 80 p refs
(AD-A083899; DREO-TN-80-1) Avail: NTIS HC A05/MF A01 CSCL 09/1

A review of TWT technology is presented comparing selected aspects and design procedures relative to application. The general theory of operation of various types of TWT designs is discussed together with a review of principles of their construction and trade offs. The travelling-wave tube (TWT) was invented by R. Kompfner in 1943, and the principle of TWT amplification was demonstrated by him at Birmingham University in the same year. A small signal theory of this device was extensively developed by J.R. Pierce. The TWT has been constructed to operate at many wavelengths, ranging from one meter to one millimetre. It has found wide application primarily because at any given frequency or power level, it offers much more bandwidth than any of its competitors. The travelling-wave tube, though structurally simple, is a 'Constructred Complication'. Because of its structural simplicity, TWTs have been built to operate at frequencies as high as 50 GHz. Modern requirements for TWT amplifiers often call for very wide bandwidths combined with high power output. For any practical application an ideal TWT is seldom available as an 'off-the-shelf' item mainly because more than two dozen independent parameters are required in order to completely describe the tube. GRA

N80-27604# Westinghouse Research and Development Center, Pittsburgh, Pa.
THEORY AND DESIGN OF ELECTRICAL ROTATING MACHINERY Final Report, 1 May 1972 - 31 Oct. 1979
W. J. Carr, Jr. Apr. 1980 50 p refs
(Contract N00014-72-C-0432)
(AD-A083499) Avail: NTIS HC A03/MF A01 CSCL 09/3

The objective of this program was to contribute toward new and improved rotating machines for Naval applications, with emphasis on superconducting machinery. Work has been performed on the theory of ac losses in multifilament superconductors and experiments were made to check the theory. A list of publications and abstracts of scientific papers published under the contract is given, and a review is given of the theory of losses. A macroscopic theory for superconductivity in multifilament superconductors was developed, and the theory was used to calculate the hysteresis and eddy current losses which occur in the presence of changing magnetic fields. Both the transverse field and the longitudinal field cases were considered, and also the self-field loss of an alternating transport current, along with some examples of the combined loss due to alternating applied field and transport current. The results are useful for the design of superconducting devices, such as superconducting motors and generators. A small amount of additional work was done on studies of novel homo- and heteropolar motors. GRA

N80-27605# RCA Corp., Lancaster, Pa. SSD-Electro-Optics and Devices.
MANUFACTURING METHODS AND TECHNOLOGY MEASURE FOR FABRICATION OF SILICON TRANSCALENT RECTIFIER Interim Report, 17 Dec. 1978 - 22 Oct. 1979
B. B. Adams, M. F. DeVito, W. L. Krown, and R. E. Reed Oct. 1979 65 p
(Contract DAAK70-78-C-0120)
(AD-A083122) Avail: NTIS HC A04/MF A01 CSCL 09/1

Successfully completed were the fabrication and testing of the ten confirmatory samples of Silicon Transcalent Rectifiers. This report thoroughly describes the test results as well as the basis for selecting the prototype design. It also includes a picture or block diagram of each test circuit utilized. All devices passed all inspections with a yield of 100%. GRA

N80-27606# Hughes Aircraft Co., Torrance, Calif. Torrance Research Center.
THE 140 GHz PULSED IMPATT COMBINER HIGH POWER SOURCE Final Report, 1 Jul. 1977 - 30 Nov. 1978
T. T. Fong, T. A. Midford, E. M. Nakaji, and Y. C. Ngan Jan. 1980 103 p refs
(Contract DAAK11-77-C-0040)
(AD-A083450; AD-E430384; HAC-W-42585; ARBRL-CR-00414) Avail: NTIS HC A06/MF A01 CSCL 09/1

The objective of this program was to develop silicon IMPATT diode and power combiner circuit technology in order to demonstrate improved pulse power generating capability at 140 GHz. The program efforts have led to significant advances in the state-of-the-art for pulsed solid state power generation IND-band. The diodes fabricated for this program were double drift IMPATT's with active regions formed by a combination of n-type epitaxial growth and multiple dose/energy p-type ion implants. Copper heat sinks were used. The most successful diode package configuration was a double quartz standoff configuration. The three types of power combining structures investigated were: (1) a resonant rectangular waveguide structure with center-mounted diodes; (2) a variation of 1, employing the coplanar biasing configuration; (3) a rectangular waveguide combiner with sidewall-mounted diodes Kurakowa circuit. The rectangular cavity with sidewall mounted diodes was by far the most successful. In this circuit, power from two pulsed diodes was combined with approximately 90% combining efficiency. High peak power output at 14 GHz was achieved for both single and multiple diode oscillators. Single diode peak power levels of 3.0 watts at 3% efficiency were obtained for a 100 ns pulse length and a 50 KHz pulse repetition frequency. A two-diode power combiner based on an oversize version of Kurakowa circuit was constructed which produced 3.0 watts of peak output power. Two high power pulsed sources complete with modulators were delivered to the Army. One of these sources is a single diode oscillator, the other a two diode power combiner oscillator. Both of these sources meet the program object of 3.0 watts of peak output power at pulse lengths of 50-100 ns. GRA

N80-27607# Varian Associates, Palo Alto, Calif. Research Solid State Lab.
NONCOPLANAR HIGH POWER FET Final Report, Dec. 1974 - Nov. 1978
S. G. Bandy, D. M. Collins, D. R. Decker, J. H. Dully, R. D. Fairman, S. B. Hyder, C. K. Nischimoto, and R. Sahkaran Dec. 1979 138 p refs
(Contract N00014-76-C-0303; RF54581001)
(AD-A083682) Avail: NTIS HC A07/MF A01 CSCL 09/1

Using a p- substrate as the gate and employing low-doped V-grooves under the source and drain to reduce parasitic capacitances, a noncoplanar power FET was designed and fabricated which achieved submicron gate lengths with photolithography masks employing a resolution limit of several microns. Device performance was limited by low values of pinch-off voltage and gate breakdown voltage. Ion implantation or diffusion should enable the breakdown voltage to be raised by virtue of separating the p-n junction from the growth interface. GRA

N80-27608# Varian Associates, Palo Alto, Calif.
CONTIGUOUS GRIDDED GUN DEVELOPMENT PROGRAM Final Technical Report, Mar. 1978 - Aug. 1979
Glen Huffman Griffiss AFB, N.Y. RADC Mar. 1980 33 p
(Contract F30602-78-C-0123; AF Proj. 4506)
(AD-A084046; RADC-TR-80-51) Avail: NTIS HC A03/MF A01 CSCL 09/1

A gridded gun, suitable for operating megawatt level linear beam tubes, has been designed and tested at lower levels in a beam analyzer. The new gun features a shadow grid in contact with the cathode surface. A major goal was to achieve low control grid interception. Guns with contiguous grid systems are in common use in low and medium power tubes. The purpose of this program was to extend existing lower power gridded gun technology to the megawatt level. The basic gun parameters including beam diameter, voltage, current, perveance and grid operating voltage are all quite conservative and readily achievable in an 83 kV gun. The most critical requirement was that the maximum outer diameter of the gun assembly not exceed 5.48 inches. This limit forced a compromise between cathode emission density and high voltage gradients and dictated the use of a tungsten matrix cathode. A scale model gun was built and tested in a beam analyzer. After modification to the design, a full-scale gun was built and also tested in the beam analyzer. Extrapolations from the beam analyzer test data show that the gun should meet all performance objectives at full power except for heater power and grid bias voltage. The intercepted control grid current cannot be accurately estimated for full power operation, but it is believed that it will be less than the 40 milliamps specified. GRA

N80-27609# Rutgers - The State Univ., Piscataway, N. J. High Pressure Materials Research Lab.
PIEZOELECTRICITY IN NYLON 11
B. A. Newman, P. Chen, K. D. Pae, and J. I. Scheinbeim 1 Apr. 1980 19 p refs Submitted for publication
(Contract N00014-75-C-0540; NR Proj. 356-564)
(AD-A083719; TR-19) Avail: NTIS HC A02/MF A01 CSCL 11/9

At the present time only poled, crawn poly vinylidene fluoride PVF 2 films give evidence of sufficiently high piezoelectric response to be useful in device applications, and for this reason the great majority of research has centered around this polymer. As in the case of PVF 2, many of the odd nylons crystallize in a polar space group with a large net dipole moment in the unit cell. On the basis of the understanding now reached of the properties of poled PVF 2 films it would appear that the occ nylons have the potential to make films with high piezoelectric activity. Piezoelectricity and pyecelectricity in nylon 11 films have been studied previously and piezoelectric strain coefficients found were higher than most polymers but still two orders of magnitude less than the corresponding activity found in poled oriented PVF 2 d 31 approx. 20p C/N . Studies carried out in this laboratory have shown that by appropriate variation of poling conditions and sample microstructure quite large piezoelectric constants can be obtained for nylons 11 films d 31 approx. 3p C/N. The dependence of the piezoelectric strain constant d 31 on poling temperature, poling field and crystal structure will be discussed. GRA

N80-27610# Naval Postgraduate School, Monterey, Calif.
ANALYSIS OF A TWO-FLUID EHD POWER GENERATOR INCLUDING EFFECTS OF COMPRESSIBILITY
T. H. Gawain and Oscar Biblarz Jan. 1980 94 p refs
(Contract ER-78-A-03-2122)
(AD-A084125; NPS67-80-002) Avail: NTIS HC A05/MF A01 CSCL 10/2

A detailed analysis and method of calculation is presented for determining the complete thermodynamic cycle of either a one-fluid or a two-fluid electrohydrodynamic (EHD) power generator. The analysis takes fully into account the compressibility of the media. Parameters are included which express the thermodynamic losses in the various components of the overall system. The severe restriction on output created by the electrical breakdown limit of the medium is clearly shown. The method for computing the net-electrical work output per unit mass of primary fluid and the net overall thermal efficiency of the system is carefully developed. The calculation procedure is illustrated by a completely worked out numerical example. The techniques presented here may be used to determine the performance

possibilities and limitations of various one-fluid and two-fluid EHD power generators. GRA

N80-27611# Commonwealth Associates, Inc., Jackson, Mich.
MODEL FOR THE READY DEFINITION AND APPROXIMATE COMPARISON OF ALTERNATIVE HIGH VOLTAGE TRANSMISSION SYSTEMS
Dec. 1978 183 p
(Contract ET-78-C-05-5916)
(DOE/ET-5916-1) Avail: NTIS HC A09/MF A01

A model of generic overhead transmission systems in the range of 362 to 1200 kV ac, and + or - 400 to + or - 800 kV dc is developed. Such generic systems are to include: (1) transmission from generation to load; and (2) interconnection of two large integrated systems, with and without the existence of an underlying, lower voltage network in either case. The model provides a means whereby an engineer with some experience in power systems planning can make a reconnaissance study of alternatives within a relatively short span of time and with fair accuracy. Given an amount of power to be transferred over a specified distance, the model is used: to define the workable alternatives in terms of voltages, number of lines, series compensation, and certain other factors affecting transfer capability; to delineate other salient features of the selected alternatives, notably shunt compensation requirements; and to compare the alternatives in terms of potentially relevent benefits and costs. The significant properties of the model, the basis and assumptions necessary to its formulation, instructions for its use, and inherent limitations upon the accuracy to be expected are described. DOE

N80-27612# National Bureau of Standards, Washington, D.C. National Engineering Lab.
DEVELOPMENT OF FLAMMABILITY CRITERIA FOR TRANSFORMER DIELECTRIC FLUIDS Final Report
Richard G. Gann Feb. 1980 56 p refs Sponsored in part by DOE, Washington, D.C.
(PB80-163777; NBSIR-80-1992) Avail: NTIS HC A04/MF A01 CSCL 09A

The fire safety requirements for electrical insulating fluids are examined. The hazards are delineated and the magnitude of the transformer fire problem is assessed. The fire code and standard test methods are shown to be inadequate. Approaches to fluid fire performance testing are presented as a basis for evaluating the economic impact of alternative fire safety strategies. GRA

N80-27613# National Bureau of Standards, Washington, D.C. National Engineering Lab.
DEVELOPMENT OF TEST STRUCTURES FOR CHARACTERIZATION OF THE FABRICATION AND PERFORMANCE OF RADIATION-HARDENED CHARGE-COUPLED DEVICE (CCD) IMAGERS Annual Report, 1 Dec. - 30 Nov. 1978
G. P. Carver and S. Rubin Mar. 1980 23 p refs Sponsored in part by Charles Stark Draper Lab., Inc., Cambridge, Mass.
(PB80-160708; NBSIR-80-2000) Avail: NTIS HC A02/MF A01 CSCL 09A

Test structures and test methods useful for the characterization of radiation hardened charged coupled device imagers are evaluated. The results of measurements on buried channel gated diodes and buried layer metal oxide semiconductor field effect transistor direct current profilers are reported. Further advantages in the development of the integrated gated diode electrometer are also reported. GRA

N80-27614# National Technical Information Service, Springfield, Va.
PRINTED CIRCUITS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Feb. 1980
William E. Reed Apr. 1980 168 p Supersedes NTIS/PS-79/0241; NTIS/PS-78/0222
(PB80-807571; NTIS/PS-79/0241; NTIS/PS-78/0222) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

Citations from worldwide research on the design, fabrication, testing, and applications of printed circuits are presented. Subjects include printed circuit boards, bonding, soldering, interconnections, coatings, layout, and inspection. This updated bibliography contains 161 abstracts, 77 of which are new entries to the previous edition. GRA

N80-27615# National Technical Information Service, Springfield, Va.
PRINTED CIRCUITS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Feb. 1980
William E. Reed Apr. 1980 182 p Supersedes NTIS/PS-79/0239; NTIS/PS-78/0221
(PB80-807563; NTIS/PS-79/0239; NTIS/PS-78/0221) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

The design, fabrication, testing, and applications of printed circuits are presented in these citations of Federally-sponsored research reports. Research on computer aided design, soldering, etching, plating, photolithography, and materials are cited. This updated bibliography contains 175 abstracts, 41 of which are new entries to the previous edition. GRA

N80-27616# National Technical Information Service, Springfield, Va.
MICROWAVE OSCILLATORS. CITATIONS FROM THE NTIS DATA BASE Progress Report, Apr. 1976 - Mar. 1980
William E. Reed Apr. 1980 279 p Supersedes NTIS/PS-79/0414; NTIS/PS-78/0333
(PB80-808280; NTIS/PS-79/0414; NTIS/PS-78/0333) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

Federally sponsored research reports are cited on the design, development, application, reliability, and radiation effects of microwave oscillators. This updated bibliography contains 272 abstracts, 22 of which are new entries to the previous edition. GRA

N80-27617# National Technical Information Service, Springfield, Va.
MICROWAVE OSCILLATORS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Mar. 1980
William E. Reed Apr. 1980 221 p Supersedes NTIS/PS-79/0416; NTIS/PS-78/0334
(PB80-808298; NTIS/PS-79/0416; NTIS/PS-78/0334) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

The bibliography contains reports from worldwide research on the design, performance, properties and applications of microwave oscillators, including Gunn, IMPATT, transistor, TRAPATT, transferred electron, Schottky, and surface acoustic wave oscillators. This updated bibliography contains 214 abstracts, 88 of which are new entries to the previous edition. GRA

N80-27618# National Bureau of Standards, Washington, D.C. National Engineering Lab.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: MODULATION MEASUREMENTS FOR MICROWAVE MIXERS Final Report, 1 Jan. 1970 - 31 Mar. 1974
James M. Kenney Feb. 1980 90 p refs Sponsored in part by Naval Electronic System Command
(PB80-166952; NBS-SP-400-16; LC-79-600161) Avail: NTIS HC A05/MF A01 CSCL 14B

The measurement of mixer conversion loss using periodic or incremental modulation of the local oscillator, and the evaluation and minimization of the associated systematic and random uncertainties, are discussed in terms of an X-band mixer measurement system. It is shown that the systematic uncertainty in the incremental modulation method of measuring conversion loss results largely from the uncertainties in the calibration of microwave attenuation and power. It is also shown that the modulation (periodic modulation) and incremental (incremental modulation) methods of measuring conversion loss are essentially identical, the only practical distinction being in the somewhat different instrumentation required by the different modulation rates. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N80-27619 Princeton Univ., N. J.
PREDICTOR-CORRECTOR METHODS FOR TIME DEPENDENT COMPRESSIBLE FLOWS Ph.D. Thesis
Keith Meintjes 1980 239 p
Avail: Univ. Microfilms Order No. 8015407

A general family of predictor-corrector finite difference methods, with application to problems in viscous, compressible fluid dynamics is considered. The generalization is sufficiently broad to include a number of known methods but still allows the necessary detailed analysis to be performed. Some properties are continuous functions of the generalizing parameters and may be optimized, while other characteristics are independent of these parameters and guaranteed a priori. It is shown analytically and numerically that the behavior of the computational solution of the Navier-Stokes equations at least for quasi one dimensional flow, is given by the study of Burgers' equation. Dissert. Abstr.

N80-27620 Houston Univ., Tex.
AN EXPERIMENTAL STUDY OF THE COHERENT MOTIONS IN AN AXISYMMETRIC MIXING LAYER Ph.D. Thesis
Arch Ray Clark, III 1979 447 p
Avail: Univ. Microfilms Order No. 8014104

An axisymmetric free mixing layer was investigated using both hot-wire measurements and high speed flow visualization photography. The large scale structures were characterized on the basis of wavelength, convection velocity and frequency (Strouhal number) of the dominant (i.e., most energetic) scale (eddy). Measurements of the spacetime (longitudinal velocity) correlation and its complete (double) Fourier transform, viz., the wavenumber frequency spectral function, were carried out along lines of constant mean velocity in the mixing layer over the region of self preservation. Dissert. Abstr.

N80-27621 Illinois Univ. at Chicago Circle, Chicago.
THE STUDY OF NON-NEWTONIAN FLOWS IN THE FALLING BALL VISCOMETER Ph.D. Thesis
Young Ill Cho 1980 179 p
Avail: Univ. Microfilms Order No. 8014222

Variational methods in conjunction with the power law model were used to predict the drag coefficient of a slowly moving sphere. Two upper bound solutions were recalculated with the first approximation stream function and Tomita's modified stream function, resulting in a substantial improvement over the previous reported values particularly in the range of n, the power law index, less than 0.5. It is shown that Tomita's modified stream function known as the best function for the upper bound fails to give the Newtonian results as n approaches unity.
Dissert. Abstr.

N80-27622 California Univ., Berkeley.
SEPARATION EFFECTS IN GAS-PARTICLE FLOWS AT HIGH REYNOLDS NUMBERS Ph.D. Thesis
Joseph Adel Laitone 1979 96 p
Avail: Univ. Microfilms Order No. 8014768

A general numerical solution is presented which extends a numerical scheme for gas flow to a solution suitable for dilute gas solid particle flows over a much wider range of conditions and geometries. The proposed method is designed to solve the time dependent equations but may be used in the steady state case as well. An exact solution for the inviscid two phase flow near a stagnation point is also presented. A transformation is used that reduces the partial differential governing equation to a second order linear differential equation. The numerical method is applied to the flow of gas and particles about a cylinder. A cutoff value is found in particle size which determines particles that do not impact with the cylinder but are deflected around it. Dissert. Abstr.

N80-27623 Johns Hopkins Univ., Baltimore, Md.
A NEW THEORY OF TURBULENT CONVECTION OVER A HEATED SURFACE
Ching-Sheng Chern 1980 86 p
Avail: Univ. Microfilms Order No. 8014264

The turbulent thermal convection which exists between two horizontal plates was investigated and field observations of the planetary boundary layer were made under unstable conditions. It is shown that near a surface there exist large eddies with a typical horizontal length scale of the order of H, the total convection layer thickness. The interaction of these big eddies with the surface and general frictional processes in the wall region are associated with a second boundary layer, called the mesolayer, whose thickness, when scaled on the buoyancy flux at the wall q and viscosity v, is proportional to R(1/4). In the mesolayer, the big eddies are anisotropic and three dimensional. They get their kinetic energy from the energy of the outer region which originates as available potential energy. Dissert. Abstr.

N80-27624 California Univ., Berkeley.
NUMERICAL METHODS FOR INVERSE TRANSIENT HEAT CONDUCTION PROBLEMS Ph.D. Thesis
Diego Antonio Murio 1979 118 p
Avail: Univ. Microfilms Order No. 8014823

A transient heat conduction problem with slab symmetry. The temperature and heat flux histories f(t) and q(t) on the right hand surface are desired and unknown, but the temperature and heat flux histories F(t) and Q(t) on the left hand surface are approximately measurable for all t in (minus infinity, infinity). Certain inverse and direct convolution kernels are introduced with which the numerical problem is solved with an absolute minimum of computation. Dissert. Abstr.

N80-27625 California Univ., Berkeley.
HEAT AND MASS TRANSFER FROM A ROTATING DISK WITH PHASE CHANGE Ph.D. Thesis
Chi-Sheng Wang 1979 118 p
Avail: Univ. Microfilms Order No. 8014921

Experimental measurements were made in a rotating disk evaporator. The condensate flow rate, pressure, and temperature across the disk and the rotational speed of the disk were measured. The overall heat transfer coefficients were determined from the above measured data. Tests were carried out on a copper disk with and without a wiper on the evaporation surface of the disk and on a monel disk with a wiper. Evaporation heat transfer coefficients were calculated based on the thermal resistance method. A study of impinging, rotating, and condensing flow was carried out. An integral method was used to obtain the results for the impinging flow case. Two impinging conditions are considered: A liquid boundary layer only, without a vapor drag effect and two boundary layers, liquid and vapor, with a vapor drag effect. The results show that the copper disk with a wiper yields higher condensation rates, evaporation heat transfer coefficient, and overall heat transfer coefficients than does the copper disk without a wiper. Also, the copper disk with a wiper yields higher values than does the monel disk with a wiper. The theoretical studies show that the effect of vapor drag on the condensation heat transfer is small for impinging flow.
Dissert. Abstr.

N80-27626 California Univ., Berkeley.
FINITE DIFFERENCE SOLUTION OF THE NONLINEAR COSSERAT JET EQUATIONS FOR A VISCOUS FLUID WITH SURFACE TENSION Ph.D. Thesis
Sabbas Joseph Shine 1979 138 p
Avail: Univ. Microfilms Order No. 8014877

A simultaneous finite difference solution of the nonlinear Cosserat fluid jet equations for a semi-infinite jet emanating from a nozzle is presented. The problem is treated as a time dependent one with a small amplitude periodic excitation of the velocity at the nozzle. Solutions for the jet radius and velocity are computed until the radius becomes zero or the absolute value of the velocity exceeds a chosen maximum value. It is shown that when the dimensionless frequency of the excitation is less than one the generated wave grows in amplitude until it finally breaks up the jet at a definite point downstream. The breakoff point depends on the frequency and amplitude of the excitation, the jet velocity, and the viscosity of the fluid. When

the frequency of excitation is more than one the disturbance is stable and therefore no jet breakup occurs. Even for the unstable frequencies of excitation is less than one, high viscosity can appreciably damp out the growth of the disturbance.
Dissert. Abstr.

N80-27627 Purdue Univ., Lafayette, Ind.
THE SOLUTION OF BOUNDARY VALUE PROBLEMS IN DIFFUSIVE HEAT AND MASS TRANSFER WITH CONVECTION: FUNCTIONAL ANALYTIC METHODS Ph.D. Thesis
Eleftherios Papoutsakis 1979 303 p
Avail: Univ. Microfilms Order No. 8015503

An entirely analytical solution to the Graetz problem with a variety of wall boundary conditions was formulated based on a self-adjoint formalism resulting from a decomposition of the convective diffusion equation into a pair of first order partial differential equations. Physically, the decomposition views the convective diffusion process as a pair of stipulations on how the temperature (or concentration) and the axial energy (or mass) flow through a partial tube cross section vary with radial and axial distances. The solutions obtained are simple, and readily computed. A variety of computational results are also discussed physically.
Dissert. Abstr.

N80-27628 Cornell Univ., Ithaca, N. Y.
TURBULENCE AND VORTEX DYNAMICS IN TWO DIMENSIONS Ph.D. Thesis
Hassan Aref 1980 126 p
Avail: Univ. Microfilms Order No. 8015634

The dynamics of a system of point vortices in the plane is studied, both analytically and numerically, as a model of two dimensional flow. It is argued, that the basic interacting unit in an N-vortex system is a triple of vortices. It is a classical result that the motion of three point vortices of arbitrary strengths, defines an integrable Hamiltonian system. A novel analysis of the properties of the motion of three vortices is given using a phase diagram technique. This generalizes recent work by Novikov on the motion of three identical vortices. A complete classification is obtained of possible regimes of motion as the vortex strengths are varied. When the vortex strengths (K sub 1, K sub 2, K sub 3) have the values (+K,+K,-K) the phase diagram can be interpreted in terms of the scattering of a neutral vortex pair by a single vortex. Details of the scattering process are presented. If the harmonic mean of the three strengths vanishes, the vortex triangle can expand or contract without change of shape. For certain initial conditions the triangle collapses to a point in a finite time for this case.
Dissert. Abstr.

N80-27629 California Univ., Berkeley.
ANALYSIS OF ALGORITHMS FOR ADVECTION IN DISCONTINUOUS FLOWS Ph.D. Thesis
Charles Paine Fenimore 1979 110 p
Avail: Univ. Microfilms Order No. 8014674

An analysis is presented of two algorithms for the approximate solution of the equations of multifluid, gas dynamic flow in two space dimensions. Sharp interfaces separate the distinct fluids and the flow field can have discontinuities such as shocks and slip lines. The species are advected by the fluid velocity field, and there is no diffusion of the species. Both algorithms are alternating direction methods which reduce the full two dimensional problem to a sequence of one dimensional ones. A hybrid scheme is presented which has high resolution and can represent phenomena occurring on a scale smaller than the mesh size. The hybrid scheme employs the detailed information produced by Glimm's method to advance the fluid interfaces defined by the straight line algorithm. The hybrid is seen to conserve species. The method is applied to test problems in which one dimensional waves move obliquely to the two dimensional mesh sweeping over a blob in the flow. It is found that the method while of low order is able to represent interfaces sharply, even for very thin blobs. Numerical and graphical results are included.
Dissert. Abstr.

N80-27630*# Remtech, Inc., Huntsville, Ala.
SSV GENERIC OFT FIRST STAGE ASCENT BASE CONVECTIVE HEATING ENVIRONMENTS
Robert Lee Bender, Jr. and Young C. Lee 31 Oct. 1978 63 p refs
(Contract NAS8-29270)
(NASA-CR-161499; RTR-014-6) Avail: NTIS HC A04/MF A01 CSCL 20D

Space Shuttle Vehicle (SSV) base convective heating environments during the recirculated flow time segment of first stage ascent were determined for the Generic OFT trajectory and performance conditions. These environments are presented in the attachments as cold wall convective heat transfer coefficients for individual or groups of design points for all affected SSV base surfaces. Two gas recovery temperatures applicable to upper and lower base region surfaces are also included. The environments were based upon magnitudes and trends from analysis of data taken during Base Heating Tests IH-39, IH-75, and IH-83. The plume heating trajectory and performance data were supplied by Rockwell International for both the OFT-1 Generic Mission A and Mission C.
A.R.H.

N80-27631*# Remtech, Inc., Huntsville, Ala.
ADDENDUM TO SSV GENERIC OFT FIRST STAGE ASCENT BASE CONVECTIVE HEATING ENVIRONMENTS
Robert Lee Bender, Jr. and Young C. Lee 20 Dec. 1978 5 p ref
(Contract NAS8-29270)
(NASA-CR-161497; RTR-014-8) Avail: NTIS HC A02/MF A01 CSCL 20D

Convective environments for OFT Mission C are presented in graphs for first stage convective heating to the internal surfaces of the OMS nozzle, to the aft facing 8 and 9 RCS nozzles, and to the base (trailing edge) of the vertical tail.
A.R.H.

N80-27632*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INFLUENCE OF PRESSURE DRIVEN SECONDARY FLOWS ON THE BEHAVIOR OF TURBOFAN FORCED MIXERS
B. Anderson, L. Povinelli, and W. Gerstenmaier Jul. 1980 28 p refs Presented at 16th Joint Prop. Conf., Hartford, Conn., 30 Jun. - 2 Jul. 1980; sponsored by AIAA, ACME, and SAE
(NASA-TM-81541; E-493) Avail: NTIS HC A03/MF A01 CSCL 20C

A finite difference procedure was developed to analyze the three dimensional subsonic turbulent flows in turbofan forced mixer nozzles. The method is based on a decomposition of the velocity field into primary and secondary flow components which are determined by solution of the equations governing primary momentum, secondary vorticity, thermal energy, and continuity. Experimentally, a strong secondary flow pattern was identified which is associated with the radial inflow and outflow characteristics of the core and fan streams and forms a very strong vortex system aligned with the radial interface between the core and fan regions. A procedure was developed to generate a similar generic secondary flow pattern in terms of two constants representing the average radial outflow or inflow in the core and fan streams as a percentage of the local streamwise velocity. This description of the initial secondary flow gave excellent agreement with experimental data. By identifying the nature of large scale secondary flow structure and associating it with characteristic mixer nozzle behavior, it is felt that the cause and effect relationship between lobe design and nozzle performance can be understood.
E.D.K.

N80-27633*# Tennessee Univ., Knoxville. Dept. of Engineering Science and Mechanics.
RESEARCH ON NUMERICAL ALGORITHMS FOR THE THREE DIMENSIONAL NAVIER-STOKES EQUATIONS. 1: ACCURACY, CONVERGENCE AND EFFICIENCY Interim Technical Report, 1 Oct. 1978 - 30 Sep. 1979
A. J. Baker Sep. 1979 61 p refs
(Grant AF-AFOSR-0005-79; AF Proj. 2307)
(AD-A083864; AFFDL-TR-79-3141) Avail: NTIS HC A04/MF A01 CSCL 12/1

The objective of this research is to develop a highly accurate and efficient numerical solution algorithm for the non linear three dimensional Navier-Stokes equations for aerodynamics applications. A candidate algorithm has been derived employing finite element interpolation theory, the non-linear extension of quasi-variational principles, and the concept of tensor product bases. The resultant solution statement is rendered soluable using an implicit integration algorithm, and the replacement of the

standard Jacobian of a Newton iteration algorithm with a tensor matrix product form. A linearized stability analysis indicates the basic algorithm is spatially fourth order accurate in its most elementary embodiment. The control of an added dissipation mechanism can elevate this to sixth order, but numerical experimentation indicates the resultant artificial diffusion is unacceptably large. By the same measure, this additional accuracy is intrinsic to the quadratic element embodiment of the algorithm with freedom from artificial diffusion. The results of several numerical experiments for single and multi dimensional convection-dominated test problems confirms the basic viability of this algorithm and its tensor produce formulation. The latter is of paramount importance in rendering the algorithm nominally as efficient as familiar lower order accurate finite difference formulations. GRA

N80-27634# Rockwell International Corp., Columbus, Ohio. North American Aircraft Div.
COMPUTATION OF THE TURBULENT MIXING IN CURVED EJECTORS Final Report, 1 Sep. 1978 - 31 Aug. 1979
E. F. Schum, P. M. Bevilaqua, and S. V. Patankar 30 Apr. 1980 44 p refs
(Contract N00014-78-C-0557; RF41411B01)
(AD-A083905; NR80H-11; ONR-CR-212-249-2F) Avail: NTIS HC A03/MF A01 CSCL 20/4

A numerical method has been developed to calculate the effects of curvature on the turbulent mixing within a thrust augmenting ejector. Curvature modification are included in both the kinetic energy and dissipation equations of the turbulence model. The elliptic effects of curvature on the mean flow are determined by combining an elliptic solution for the pressure field with a conventional marching solution for the velocity field. Predictions of the velocity profiles for jets and curved duct flows are compared with experimental data. Computation of the curvature effects are shown for an ejector having Coanda jets and one central jet. GRA

N80-27635# Purdue Univ., Lafayette, Ind.
FLOW FIELD MEASUREMENT USING RAMAN AND LDV TECHNIQUES Interim Report
S. Lederman, A. Celentano, and J. Glaser Apr. 1979 37 p refs Prepared in cooperation with Polytechnic Inst. of New York, Farmingdale
(Contract N00014-75-C-1143; NR Proj. 098-038; Proj. SQUID)
(AD-A083767; SQUID-PIB-36-PU) Avail: NTIS HC A03/MF A01 CSCL 20/4

The application of spontaneous Raman, Coherent Antistokes Raman Scattering (CARS) and Laser Doppler Velocimeters (LDV) techniques to a wide spectrum of flow fields confirms the basis hypothesis, that these laser based diagnostic techniques have a very wide range of applicability and can be instrumental in providing experimental data in friendly as well as hostile environments unobtainable by conventional means. The data can be obtained non-intrusively and remotely. GRA

N80-27636# Purdue Univ., Lafayette, Ind.
COLLOQUIUM ON FLOW SEPARATION
Roger L. Simpson Aug. 1979 107 p refs Prepared in cooperation with Southern Methodist Univ., Dallas
(Contract N00014-75-C-1143; NR Proj. 098-038; Proj.-SQUID)
(AD-A083741; SQUID-SMU-3-PU) Avail: NTIS HC A06/MF A01 CSCL 20/4

Turbulent flow separation continues to be a nuisance to fluid dynamicists because it may be present in many practical machines or devices, thus reducing their performance, and because there is no adequate method to calculate such flows. In general, the maximum performance of such machines occurs at conditions close to the onset of separation. In order of increasing difficulty, designers need to know (a) whether or not a boundary layer separates for a prescribed pressure distribution, (b) how the pressure distribution is affected by boundary layer development with small regions of separated flow, and (c) how the overall performance is affected when large regions of separation are present. This Colloquium on Turbulent Flow Separation was held by Project SQUID at SMU to discuss fruitful areas for future research. A number of active researchers were invited to participate in discussions on five topics: terminology, measurements, flow modeling, unsteady effects, and control of separated flow. These topics are fundamental to future advances since a common nomenclature should be used to describe phenomena that are measured and modeled. GRA

N80-27637# Michigan State Univ., East Lansing. Div. of Engineering Research.
SUMMARY OF THE AFOSR/MSU RESEARCH SPECIALISTS WORKSHOP ON COHERENT STRUCTURE IN TURBULENT BOUNDARY LAYERS Final Report, 1 Jul. - 30 Sep. 1979
S. J. Kline and R. E. Falco 30 Sep. 1979 69 p refs Workshop held at East Lansing, Mich., 30 Jul. - 1 Aug. 1979 Prepared in cooperation with Stanford Univ., Calif. Sponsored in part by Michigan State Univ.
(Contract F49620-79-C-0211; AF Proj. 2307)
(AD-A083717; AFOSR-80-0290TR; CSL-80-1) Avail: NTIS HC A04/MF A01 CSCL 20/4

There was general agreement that progress towards a consensus of turbulent boundary layer structural information was made, and that the directions which future research work should take were clarified. There was general recognition that a number of different coherent motions exist in the boundary layer, and that different techniques (both visual and probe) emphasize some at the expense of others. It is necessary to determine what role each of the coherent motions play, as well as the importance of the interactions between these motions. Substantial progress has been made, but a consensus emerged that more overlap of techniques and objectives is needed, and that more experiments which combine flow visualization with quantitative measurements should be performed. Three different theoretical approaches were discussed. Each qualitatively simulated the occurrence of some of the observed structural features, via their underlying mechanisms. At this stage, none of the theories can be considered complete or predictive. Some potentially important qualitative correspondences were made between numerical large eddy simulations and recent wall region data. GRA

N80-27638# Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
CAVITATION DAMAGE MECHANISMS: REVIEW OF LITERATURE Final Report, Aug. 1977 - Sep. 1979
D. C. Wiggert, C. S. Martin, and H. Medlarz Wright-Patterson AFB, Ohio AFAPL Feb. 1980 58 p refs
(Contract F33615-77-C-2036)
(AD-A083805; AFAPL-TR-79-2125) Avail: NTIS HC A04/MF A01 CSCL 13/7

This report is a companion volume to 'Cavitation Damage Mechanisms: Experimental Study of Cavitation in a Spool Valve.' The state-of-the-art available in the literature is reviewed relative to occurrence of cavitation, the effects of dissolved and free gas, and so-called secondary aspects of combustion/sonoluminescence and electrical/chemical effects. It should be noted that a paucity of literature exists with regard to cavitation in oil hydraulic systems; consequently much of the material discussed deals with water as the working fluid. Throughout the text, clear distinctions are made as to the fluid under discussion. The small number of references which do relate to oils are covered as thoroughly as deemed necessary. The last topic to be presented concerns cavitation in hydraulic actuators. This is a markedly different type of cavitation than is dealt with in the present experimental study; it is included for completeness and due to the fact that it can be a potential problem in control system performance, although most often it creates no permanent mechanical damage to actuator components. GRA

N80-27639# College of Aeronautics, Cranfield (England).
INVESTIGATION OF THREE-DIMENSIONAL SHOCK WAVE BOUNDARY LAYER INTERACTIONS. A FLOWFIELD MODEL OF THE GLANCING SHOCK/TURBULENT BOUNDARY LAYER INTERACTION Final Scientific Report, Jun. 1976 - Oct. 1979
H. Kubota Jan. 1980 231 p refs
(Grant AF-AFOSR-3006-76)
(AD-A083703; COA-8001) Avail: NTIS HC A11/MF A01 CSCL 20/4

Three-dimensional glancing-shock/turbulent boundary-layer interaction has been investigated at the Cranfield Institute of Technology in two separate test programmes using a 2.5 x 2.5 inch intermittent tunnel and a 9 x 9 inch continuous tunnel, at a Mach number of approximately 2.5. The experimental results

include oil-flow pictures, vapour-screen photographs, surface static pressure distributions, local heat transfers, liquid crystal pictures of surface temperature, and viscous layer surveys. The test data indicate that the interaction region consists of two different viscous flows, the side-wall boundary layer and an induced layer originating near the shock generator root and crossing the path of the side-wall boundary layer. In this flow field model, no flow separation appears as long as the surface stream lines of the side-wall boundary layer can be pliable enough to be bent along the edge of the induced layer, even when the surface-flow deflection exceeds the shock angle. However, an ordinary separation does take place when the induced layer forces the surface stream lines to deflect beyond a maximum permissible angle. GRA

N80-27640# Army Missile Command, Redstone Arsenal, Ala. Systems Simulation and Development Directorate.

CALCULATION OF THE LAMINAR VISCOSITY OF A GASEOUS MIXTURE FOR GAS DYNAMIC MIXING COMPARISONS FOR A REACTING SHEAR LAYER

B. J. Walker Oct. 1979 55 p refs

(AD-A083970; DRSMI/RD-80-2) Avail: NTIS HC A04/MF A01 CSCL 20/4

This investigation determined the laminar viscosities of NO2 and O3 at elevated temperatures. The technique to accomplish this is relevant to other gases and a generalized method for calculation of viscosities of other gases is presented. The results are compared to the calculational method of Svehla (2) for CO2 at elevated temperatures. A cubic spline interpolation routine using a Lagrangian polynomial treatment of the end points is formulated and coded. GRA

N80-27641# Brown Univ., Providence, R. I. Div. of Applied Mathematics.

FINITE ELEMENT METHODS FOR HEAT TRANSFER PROBLEMS Final Report, 15 Jun. 1976 - 15 Sep. 1979

F. Bisshopp, R. B. Caswell, and M. E. Micheud 2 Apr. 1980 94 p refs

(Grant DAAG29-79-G-0178)

(AD-A084450; ARO-13548.2-MX) Avail: NTIS HC A05/MF A01 CSCL 20/4

At the start, three and a half years ago, the finite fluid element method Section 1 was the only one under consideration. Things went badly with that method, and progress with its implementation went far more slowly than we ever anticipated. As a result, by the end of the first year, a second method, which originally was developed for a check on results of the first, had become by far the more promising of the two. Most of this report Sections 3-6 describes progress we have made with the application of biased differences Section 2 to a variety of fairly difficult problems of numerical fluid mechanics. Finally, in the last six months of the period covered by this report, the major difficulties with finite fluid elements were overcome, so it became possible to begin a comparison of the two methods Section 6. Preliminary indications are that both methods are reliable, and both considerably more efficient than a third method with which they have been compared. Section 7 is a report of progress with a boundary integral method that is not closely related to the others except by being numerical, and Section 8 is a description of the kinds of graphical software we had to develop for interpretation of our numerical computations. GRA

N80-27642# ARO, Inc., Arnold Air Force Station, Tenn.

AN EXPERIMENTAL INVESTIGATION OF REACTIVE, TURBULENT, RECIRCULATING JET MIXING Final Report, Oct. 1977 - Feb. 1979

G. D. Smith and T. V. Giel AEDC May 1980 74 p refs

(AF Proj. 2308)

(AD-A084546; AEDC-TR-79-79) Avail: NTIS HC A04/MF A01 CSCL 20/4

An experimental investigation of ducted, two-stream, subsonic, turbulent jet mixing with recirculation was conducted. A primary jet of air at a mass flow rate of 0.580 lbm/sec and bulk velocity of 335 ft/sec was surrounded by an outer hydrogen stream at a mass flow rate of 0.002 lbm/sec and bulk velocity of 3 ft/sec (overall equivalence ratio of 0.12). The ratio of the duct to inner nozzle diameter was 2.5. Radial distributions of mean axial and radial velocity, axial and radial turbulence intensity, velocity cross correlation, gas composition, static temperature, and total pressure, as well as axial distribution of wall static pressure, are presented for axial stations from zero to six duct diameters from the nozzle exit plane, both with and without chemical reactions. The maximum turbulent intensities which occurred in the center of the mixing layer and within the recirculation eddy were very high, having values in excess of 20 percent of the jet exit velocity. The data clearly indicate that the mixing is slower in the chemically reactive flow field than in the nonreactive flow field and that the presence of chemical reactions had a significant effect on the size and location of the recirculation zone within the mixing duct. GRA

N80-27643# Aeronautical Research Associates of Princeton, Inc., N. J.

FUNDAMENTAL RESEARCH IN TURBULENT MODELING Annual Technical Report, 1 Jan. - 31 Dec. 1979

Carmen Cerasoli, Coleman dup.Donaldson, and Guido Sandri Feb. 1980 44 p refs

(Contract F44620-76-C-0048; AF Proj. 2307)

(AD-A084238; ARAP-TM-80-2; AFOSR-80-0324TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

A summary of both the theoretical and experimental studies carried out during the first year of a program of fundamental research on turbulent modeling is given. On the theoretical side, the application of a modeled tensor scale equation together with a modeled Reynolds stress equation to the case of homogeneous shear flow is discussed in some detail. It is shown that such modeling gives results that are in good agreement with experiment. On the experimental side, preliminary data on the effect of swirl on the structure of turbulence in an annular pipe flow are presented. GRA

N80-27644# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.

NUMERICAL SOLUTIONS FOR LAMINAR BOUNDARY LAYER BEHIND BLAST WAVES Interim Report

Shaowen W. Liu and Harold Mirels 1 May 1980 109 p refs

(Contract F04701-79-C-0080)

(AD-A084435; TR-0080-5940-02-2; SP-TR-80-23) Avail: NTIS HC A09/MF A01 CSCL 20/4

Numerical solutions are obtained for plane and axisymmetric laminar boundary layers induced by blast waves. Explicit dependence on time is eliminated by a similarity transformation. The entire region between the shock and the blast origin is considered. Numerical results are presented for ideal air. Wall shear and heat transfer are found to increase at a rate faster than that indicated by previous solutions for the flow directly behind the shock. The results are applicable in the laminar boundary layer region. R.C.T.

N80-27645# Naval Postgraduate School, Monterey, Calif.

***FINITE ELEMENT ANALYSIS PROGRAM (FEAP) FOR CONDUCTION HEAT TRANSFER* M.S. Thesis**

Jorge Martins Bettencourt (Portuguese Navy) Dec. 1979 163 p refs

(AD-A084522) Avail: NTIS HC A08/MF A01 CSCL 20/13

The Finite Element Analysis Program (FEAP) was expanded to solve linear and nonlinear, two and three dimensional heat conduction problems. The usual types of boundary conditions, including radiation, may be specified. A wide range of two and three time level schemes for the solution of time dependent problems is available in the program and a discussion of those most commonly used in presented. The algorithms for the solution of typical practical problems are described and several numerical examples are presented. The results are compared with the available analytical solutions. A listing of this expanded version of FEAP and the corresponding user's instructions are provided. GRA

N80-27646# Naval Ocean Systems Center, San Diego, Calif.

DIGITAL IMAGE ANALYSIS OF TWO PHASE FLOW DATA Final Report, 1979

M. M. Reischman, J. M. Holzmann, and N. H. Hughes (San Diego State Univ. Foundation, Calif.) 15 Jan. 1980 23 p refs

(AD-A084187; NOSC/TR-502) Avail: NTIS HC A02/MF A01 CSCL 20/4

The analysis of flow visualization data documenting a variety of fluid phenomena has been severely limited in the past by the subjective nature of data interpretation and limitations imposed by actual sample size. Video digitization offers a reliable method of automating the analysis of such visual data. This paper describes an experiment wherein the distribution of sizes of bubbles formed by air injection into a water stream was found. Previous results were limited to special cases due to the amount of data required for a full documentation. Several geometric and flow parameters were varied and their effects are reported. Data reduction was via a digital image processing system. This type of system holds the promise of high speed, objective data reduction for a broad range of fluid mechanics problems. GRA

N80-27647# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

TURBULENT BOUNDARY LAYERS: EXPERIMENTS, THEORY AND MODELING

Jan. 1980 386 p refs Mainly in ENGLISH; partly in FRENCH Presented at the Fluid Dyn. Panel Symp., The Hague, 24-26 Sep. 1979

(AGARD-CP-271; ISBN-92-835-0257-4) Avail: NTIS HC A17/MF A01

Experimental and theoretical research directed towards understanding the turbulent boundary layer in both incompressible and compressible fluid flow is presented. Specific topics discussed include: computer modeling techniques, coherent vortex structures, flow visualization, hot wire anemometry, nonlinear vortex interactions, decomposition of fluctuating flow fields, and turbulence during, or immediately following transition. For individual titles, see N80-27648 through N80-27672.

N80-27648# Ecole Centrale de Lyon (France). Lab. de Mecanique des Fluides.

EXPERIMENTAL METHODS AND TECHNIQUES IN TURBULENT BOUNDARY LAYER RESEARCH

Genevieve Comte-Bellot *In* AGARD Turbulent Boundary Layers Jan. 1980 35 p refs (For primary document see N80-27647 18-34)

Avail: NTIS HC A17/MF A01

The state-of-the-art of methods and techniques available to investigate turbulent boundary layers is surveyed. Three specific areas are discussed: objectives of boundary layer research, transducer techniques, and signal processing techniques. R.E.S.

N80-27649# Centre National de la Recherche Scientifique, Marseilles (France). Inst. de Mecanique Statistique de la Turbulence

AN EXPERIMENTAL STUDY OF INWARD AND OUTWARD FLOW IN A TURBULENT BOUNDARY LAYER [ETUDE EXPERIMENTALE DES APPORTS ET DES EJECTIONS DE FLUIDE DANS UNE COUCHE LIMITE TURBULENTE]

M. Elena, L. Fulachier, and R. Dumas *In* AGARD Turbulent Boundary Layers Jan. 1980 21 p refs In FRENCH; ENGLISH summary (For primary document see N80-27647 18-34)

Avail: NTIS HC A17/MF A01

Experimental results concerning the structure of the internal and external zone of the boundary layer are presented. In the viscous sublayer, the flow has obvious intermittent characteristics; particularly the inward flows from regions which are farther from the wall prevail over the outward flows and penetrate the sublayer randomly. As the number of inward flow decreases with uncreasing distance from the wall, it becomes of the same order as the number of outward flow in the fully turbulent region. The measurements of the space-time correlations reveal that, at least in the internal region, there exists a linkage between the inward and outward flows, the latter being the more dominating. Measurements of conditional probabilities show that the trajectories of these disturbances are in agreement with the trajectories obtained through visualizing or measuring thermal diffusion from a point located at the wall. Additionally, measurements of three point space-time correlations indicate that the outward flows are more coherent and spanwise thinner than the disturbances corresponding ti the inward flow. These outward flows expend when moving off the wall and diffuse through the boundary layer. R.E.S.

N80-27650# Koninklijke/Shell-Laboratorium, Amsterdam (Netherlands).

EXPERIMENTAL STUDY OF COHERENT STRUCTURES IN THE TURBULENT BOUNDARY LAYER OF PIPE FLOW USING LASER-DOPPLER ANEMOMETRY

H. R. E. vanMaanen *In* AGARD Turbulent Boundary Layers Jan. 1980 20 p refs (For primary document see N80-27647 18-34)

Avail: NTIS HC A17/MF A01

The coherent structures in the turbulent boundary layer of a pipe flow were investigated. These structures, often called bursts, are thought to be the main mechanism involved in the generation and maintenance of turbulence in flow. Measurements were carried out in a pipe 6 m long and 50 mm in internal diameter, filled with water, using a laser-Doppler velocimeter, down to 0.25 mm from the wall, with the size of the measuring volume in radial direction being 0.1 mm. The output signal of the laser-Doppler anemometer, which can be regarded as the flow velocity, was fed into a burst detector and into an electronic delay line. The output signal of the burst detector was used to conditionally average the delayed signal. The conditional averages close to the pipe wall (y(+) approximately equal to 20) were in good agreement with those found by Blackwelder and Kaplan, but further from the wall significant deviations were observed. Burst phenomena even for y(+) = 100 were found indicating that the structure is bigger than expected. Results of the measurements of the burst frequency spread as a function of the Reynolds number, as well as the conditional averages, are presented. R.E.S.

N80-27651# New York Univ., N. Y. Dept. of Applied Science.

TURBULENT BOUNDARY LAYER AT LOW AND HIGH SUBSONIC SPEEDS

V. Zakkay, V. Barra, and K. Hozumi *In* AGARD Turbulent Boundary Layers Jan. 1980 20 p refs (For primary document see N80-27647 18-34)

Avail: NTIS HC A17/MF A01

Results of simultaneous measurements of velocity, wall pressure, and wallshear fluctuations in a turbulent boundary layer are presented. The results were analyzed in an attempt to obtain a description of the coherent or quasiordered structure of the boundary layer turbulence. On a large scale, the boundary layer is dominated by vortical structures which extend to the viscid-inviscid region. The wall region is dominated by the so called bursting process. The relationship or interaction between the large scale outer structure and the turbulent bursts is still not clearly defined. The results of this investigation at high speed, while confirming some of the previous results with regard to the mean period between coherent events, and their geometrical configuration, did not yet resolve the question as to whether at high subsonic speeds there is, besides the outer flow processes, a distinct inner region. With the limited instrumentation available it was not possible at the high subsonic speed to resolve any inner sublayer region, although it was found that the outer flow structures exert a strong influence on the wall. The experimental results at low subsonic speeds, on the other hand, did identify an inner and outer region, and duplicated some of the results obtained at low subsonic speed by other investigations. R.E.S.

N80-27652# Wright State Univ., Dayton, Ohio.

COHERENT STRUCTURES IN TIME DEPENDENT SHEAR FLOWS

Herman Viets *In* AGARD Turbulent Boundary Layers Jan. 1980 14 p refs (For primary document see N80-27647 18-34) (Grant AF-AFOSR-3525-78)

Avail: NTIS HC A17/MF A01

The existence of large scale coherent structures in forced unsteady flows is demonstrated. The time dependency is produced in the free jet case by a fluidically controlled flapping jet and in the wall boundary layer case by a mechanical vortex generator. Advantages of the unsteady flows and similarities to steady turbulent shear flow structure are discussed. Author

N80-27653# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

AN INVESTIGATION OF THE STRUCTURE OF EQUILIBRIUM TURBULENT BOUNDARY LAYERS

L. F. East and W. G. Sawyer *In* AGARD Turbulent Boundary Layers Jan. 1980 19 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

Seven low speed equilibrium boundary layer flows ranging from mildly favorable pressure gradients to adverse pressure gradients almost sufficient to cause incipient separation are described. The flows are turbulent and second and third order correlations of the turbulence are included in addition to measurements of the mean flow. The flow parameters are shown to be consistant with existing equilibrium loci. It is also shown that the law of the wall applies to all the flows and that therefore the value of von Karman's 'constant' in the mixing length formulation of shear stress must vary. The data strongly support the concept of gradient diffusion and it is demonstrated that for flows in strong adverse pressure gradient the shear stress gradient results from the strong diffusion of turbulence towards the wall and not from changes in the dissipation term. Thus, although the mixing length is dependent upon pressure gradient, the dissipation length is not. R.E.S.

N80-27654# British Columbia Univ., Vancouver. Dept. of Mechanical Engineering.
EQUILIBRIUM BOUNDARY LAYERS OVER VERY ROUGH SURFACES
I. S. Gartshore and K. A. deCroos *In* AGARD Turbulent Boundary Layers Jan. 1980 11 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

Commonly used wall shear stress correlations appropriate for rough walls imply a degree of equilibrium between the boundary layer and the wall. For two roughness geometries examined experimentally in zero pressure gradient, equilibrium in the mean velocity appears to exist beyond 350 times the roughness height from the origin of roughness. For moderately close spacing of simple three dimensional roughness elements, a correlation due to Dvorak appears accurate; for less dense spacing (but still fully rough conditions) the correlation underestimates the wall stress significantly. The equilibruim boundary layer studied experimentally showed unexpectedly large turbulent intensities, constant integral length scales, no region of constant stress and a semi-logarithmic region best described with a von Karman constant of 0.36 + or - .02. Author

N80-27655# Centre d'Essai Aeronautique, Toulouse (France).
TURBULENCE BEHAVIOR IN A SHOCK WAVE/BOUNDARY LAYER INTERACTION
P. Ardonceau, D. H. Lee, T. Alziary deRoquefort, and R. Goethals *In* AGARD Turbulent Boundary Layers Jan. 1980 14 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

Two dimensional shock wave boundary layer interaction was investigated. Experiments were carried out at a nominal Mach number of 2.25 for three compression corners of 8 deg, 13 deg and 18 deg corresponding respectively to attached flow, incipient separation, and well separated flow. The measurements involved wall static pressure, static and total pressure profiles, determination of the mean and root of mean square fluctuations of the u and v velocity components with a laser Doppler anemometer, hot wire measurements of the mass flow flutustions, and spectrum analysis of the hot wire signal. R.E.S.

N80-27656# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
LONGITUDINAL VORTICES IN CONCAVE SURFACE BOUNDARY LAYER
R. I Crane and S. H. Winoto *In* AGARD Turbulent Boundary Layers Jan. 1980 10 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

Local measurements of mean and fluctuating velocity by laser anemometer were made inside the developing concave surface boundary layer in a free surface water channel at Reynolds numbers up to 16000. Concave surface radius was 3.5 times channel width and the ratio of spanwise mean boundary layer thickness to surface radius ranged between 0.03 and 0.11. Systems of longitudinal vortices developed without artificial triggering. Vortex wavelength varied across the span by as much as a factor of 2, but mean wavelength was typically 1.3 times the boundary layer thickness and did not vary significantly in the flow direction. Continuous vortex growth at Reynolds number = 9800 contrasted with apparent breakup of the vortices at Reynolds number = 16000. R.C.T.

N80-27657# Technische Univ., Berlin (West Germany). Herman-Foettinger-Inst. fuer Thermo und Fluiddynamik.
A DISCUSSION OF PROBE EFFECTS AND IMPROVED MEASURING TECHNIQUES IN THE NEAR-WALL REGION OF AN INCOMPRESSIBLE THREE-DIMENSIONAL TURBULENT BOUNDARY LAYER
J. D. Vagt and H. H. Fernholz *In* AGARD Turbulent Boundary Layers Jan. 1980 17 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

Comprehensive measurements of mean and fluctuating velocities and shear stresses are provided. It is shown that measuring techniques for such measurements are improved, especially in the near wall region of a pressure driven three dimensional boundary layer on a curved wall. R.C.T.

N80-27658*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DEVELOPMENTS IN THE COMPUTATION OF TURBULENT BOUNDARY LAYERS
Morris W. Rubesin *In* AGARD Turbulent Boundary Layers Jan. 1980 23 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

Two methods of turbulence computation are discussed in terms of their basic simularities. It is shown that the two methods are interrelated and that each can gain from advances in the other. The degree of success of a pair of increasingly complex Reynolds stress models to broaden their range of applicability is examined through comparison with experimental data for a variety of flow conditions. An example of a large eddy simulation is presented, compared with experimental results, and used to evaluate the models for pressure rate of strain correlation and dissipation in the Reynolds averaged equations. R.C.T.

N80-27659*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A NAVIER-STOKES FAST SOLVER FOR TURBULENCE MODELING APPLICATIONS
J. D. Murphy and M. W. Rubesin *In* AGARD Turbulence Boundary Layers Jan. 1980 16 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

A computer code for the evaluation and/or optimization of the predicative potential of second order turbulent closure models in simple two dimensional flow configurations is discussed. A procedure for the numerical solution of the steady constant property Navier-Stokes equations are described together with algebraic, one dimensional and two dimensional equations of turbulence closure models. Four turbulence models are compared with several sets of experimental data. The effects of initial conditions and boundary conditions are also described. The effects of purely numerical parameters, such as mesh size, boundary locations, and convergence criteria are presented. R.C.T.

N80-27660*# California Univ., Davis.
REYNOLDS STRESS CLOSURES: STATUS AND PROSPECTS
Brian E. Launder *In* AGARD Turbulent Boundary Layers Jan. 1980 13 p refs (For primary document see N80-27647 18-34) (Grant NsG-2256)
Avail: NTIS HC A17/MF A01 CSCL 20D

The basic pattern of Reynolds closures and the reason they look as an attractive type of model for practical shear flow calculations is summarized. The relationship between the organized structures and Reynolds stress closures is discussed. An outline given of fundamental developments that are being introduced to extend the modest reliability of Reynolds stress closures. R.C.T.

N80-27661*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LARGE EDDY SIMULATION OF TURBULENT CHANNEL FLOW: ILLIAC 5 CALCULATION

John Kim and Parviz Moin *In* AGARD Turbulent Boundary Layers Jan. 1980 18 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

The capabilities of large eddy simulation in the prediction and analyses of wall-bounded turbulent shear flows are demonstrated. The dynamical equations for large scale field motions are derived. The computational grid network is described and its relation to the observed physical length scales in the flow are discussed. Some aspects of the mechanics and structure of the flow are examined both in the vicinity of the wall and in regions away from the wall. An attempt is made to correlate numerical results with laboratory observations. Other significant observations and conclusions are presented. R.C.T.

N80-27662# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
A TURBULENCE CLOSURE OF THE TRANSPORT EQUATION FOR THE PROBABILITY DENSITY OF VELOCITY
M. M. Ribeiro (CTAMFUL-DTA, Lisbon) *In its* Turbulent Boundary Layers Jan. 1980 12 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

A proposal for a first order closure of the hierarchy of transport equations for the probability density of velocity in a turbulent field is presented. The fluid is assumed to be incompressible and Newtonian. The effects of the pressure deviations on the probability density are modelled based on the assumption of homogeneous behavior of the flow field. The closure is shown to be compatible with a well-known Reynolds stresses closure. Particular attention is given to the physical implications of the assumptions embodied in the modelling of the unknown terms that occur in the exact equation. R.C.T.

N80-27663# Douglas Aircraft Co., Inc., Long Beach, Calif.
MODELLING REQUIREMENTS FOR THE CALCULATION OF THE TURBULENT FLOW AROUND AIRFOILS, WINGS AND BODIES OF REVOLUTION
Tuner Cebeci and H. U. Meir (Deutsche Forschungs- und Versuchsanstalt Fuer Luft- und Raumfahrt, Goettingen, West Germany) *In* AGARD Turbulent Boundary Layers Jan. 1980 12 p refs (For primary document see N80-27647 18-34)
(Contract N00019-78-M-0466)
Avail: NTIS HC A17/MF A01

The merits of turbulence models were considered for the calculation of the flow around geometric configurations of relevance to airplane and missile design. Calculated results obtained with three turbulence models were compared to each other and to the boundary layer measurements. Significant results are reported. R.C.T.

N80-27664# Norges Tekniske Hoegskole, Trondheim. Inst. for Mekanikk.
THE TURBULENT BOUNDARY LAYER AND THE CLOSURE PROBLEM
Leif N. Persen *In* AGARD Turbulent Boundary Layers Jan. 1980 5 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

Previous attempts to establish a proper phenomenological relation for turbulent flows are reviewed followed by a suggested approach to the problem in the case of a turbulent boundary layer. An attempt is made at showing the extreme flexibility that such a relation must exhibit if it is to account for effects of outside conditions and pre-history of the flow. By selecting proper 'inner variables' as parameters and properly characterizing the outer flow it is shown how a sufficiently general phenomenological relation can be established and how the closure problem may thus be considered in a different perspective. M.G.

N80-27665# National Aerospace Lab., Amsterdam (Netherlands).
BOUNDARY LAYER MEASUREMENTS ON A TWO-DIMENSIONAL WING WITH FLAP AND A COMPARISON WITH CALCULATIONS
B. vandenBerg and B. Oskam *In* AGARD Turbulent Boundary Layers Jan. 1980 14 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

Measurements performed on a wing flap configuration which was so designed that flow separations occur nowhere apart from a small laminar separation bubble on the wing nose are presented and discussed. The measurements comprise surface pressure measurements, boundary layer and wake traverses at 16 stations, and flow visualization tests to establish the presence of separation bubbles and boundary layer transition regions. The data resolve the various flow phenomena sufficiently well to provide a significant test case for calculation methods for the flow around multielement airfoils. Comparison with such a calculation method showed satisfactory agreement in many respects. A need for improved modelling was found to exist in some regions, particularly for the wing wake above the flap. M.G.

N80-27666# Aix-Marseilles Univ. (France).
THREE-DIMENSIONAL TURBULENT BOUNDARY LAYER: RESTRUCTURATION OF AN AXISYMMETRIC FLOW SUBJECTED TO A DISCONTINUITY OF THE WALL PERIPHERAL VELOCITY [COUCHE LIMITE TURBULENTE TRIDIMENSIONNELLE: TRIQUE SOUMIS A UNE DISCONTINUITE DE LA VITESSE DE PAROI]
E. Arzoumanian, L. Fulachier, Jean Cousteix (ONERA, Toulouse), and Bertrand Aupoix (ONERA, Toulouse) *In* AGARD Turbulent Boundary Layers Jan. 1980 11 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

The influence of the rotation of a cylinder on the restructuration of a developing three dimensional boundary layer is studied by using the analysis of the mean velocity field. A three dimensional turbulent boundary layer is developed on a circular cylinder the axis of which is parallel to the flow. In the downstream region the boundary layer is fully developed and the rear part of the cylinder rotates about its axis. The peripheral velocity at the wall is practically equal to the external velocity. The model used can account for the inequality of the turbulent shear stress direction and the velocity gradient direction. Emphasis is placed on the study of the buffer layer down to the viscous sublayer. The measurements reveal that the collaterality of the flow is first obtained in a very thin region near the wall and then seems to extend progressively in the boundary layer. In contrast, the calculations indicate a more extended linear portion of the hodograph. M.G.

N80-27667# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
EVIDENCE FOR INSTABILITY-WAVES IN THE VELOCITY-FIELD OF A FULLY DEVELOPED TURBULENT CHANNEL-FLOW
Michael Hofbauer *In* AGARD Turbulent Boundary Layers Jan. 1980 5 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

The results from hot film measurements and quantitative visual investigations, performed in the turbulent flow of an oil-channel at a low Reynolds number (Re = 8000), are discussed. The main result of the hot film measurements is the power spectrum of the v-component of the fluctuating velocity. The power spectrum has regular maxima and minima. The frequencies corresponding to the maxima of the power spectrum are plotted as a function of the order n of the maxima. This graph demonstrates that the frequencies of the maxima are the harmonics of a fundamental frequency which are determined to be about 0.15 Hz. An estimation shows that the fundamental frequency is of the same order of magnitude as the roughly calculated unstable Tollmien-Schlichting frequencies of the mean turbulent velocity profile. This fundamental frequency is interpreted as the most excited frequency of Tollmien-Schlichting-like instability waves. The harmonics are believed to be due to a nonlinear amplification of the primarily excited instability waves. The evidence of regular oscillations in the near-wall region of the fully developed turbulent flow from the visual studies is examined. M.G.

N80-27668# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France).
EXPERIMENTAL RESULTS CONCERNING THE INFLUENCE OF TRANSITION PROCESSES ON THE INITIAL STRUCTURE OF A TURBULENT BOUNDARY LAYER
Daniel Arnal and Jean-Claude Juillen *In* AGARD Turbulent Boundary Layers Jan. 1980 9 p refs In FRENCH; ENGLISH

summary (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

How the initial structure of the turbulent boundary layer can be influenced by the transition mechanism is examined. In the case of zero pressure gradient the evolution from the laminar to the turbulent regime is characterized by the intermittency phenomenon; the conditional sampling of the hot wire signal shows that the turbulent spots exhibit a structure similar to the classical turbulent boundary layer structure. With a mild positive pressure gradient, it becomes difficult to describe the intermittency. When the transition is beginning downstream from the laminar separation point, the shape parameter decreases but the intermittency appears no longer. Only a progressive deformation of the instability waves is observed; at the end of the transition, the spectrum of the turbulent energy is composed of a series of peaks corresponding to harmonics of the instability waves. M.G.

N80-27669# Scientific and Technical Research Council of Turkey, Ankara.
SOME MEASUREMENTS IN SYNTHETIC TURBULENT BOUNDARY LAYERS
Osmar Savas *In* AGARD Turbulent Boundary Layers Jan. 1980 12 p refs (For primary document see N80-27647 18-34) (Grants NSF ENG-75-03694; NSF ENG-77-23541)
Avail: NTIS HC A17/MF A01

Synthetic turbulent boundary layers are examined which were constructed on a flat plate by generating systematic moving patterns of turbulent spots in a laminar flow. The experiments were carried out in a wind tunnel at a Reynolds number based on plate length of 1,700,000. Spots were generated periodically in space and time near the leading edge to form a regular hexagonal pattern. The disturbance mechanism was a camshaft which displaced small pins momentarily into the laminar flow at frequencies up to 80 Hz. The main instrumentation was a rake of 24 hot wires placed across the flow in a line parallel to the surface. The main measured variable was local intermittency; i.e., the probability of observing turbulent flow at a particular point in space and time. The results are reported in x-t diagrams showing the evolution of various synthetic flows along the plate. The dimensionless celerity or phase velocity of the large eddies is found to be 0.88, independent of eddy scale. All patterns with sufficiently small scales eventually showed loss of coherence as they moved downstream. A novel phenomenon called eddy transposition was observed in several flows which contained appreciable laminar regions. The large eddies shifted in formation to new positions, intermediate to their original ones, while preserving their hexagonal pattern. The present results, together with some empirical properties of a turbulent spot, are used to estimate the best choice of scales for constructing a synthetic boundary layer suitable for detailed study. The values recommended are: spanwise scale/thickness = 2.5, streamwise scale/thickness = 8. M.G.

N80-27670# University of Southern California, Los Angeles. Dept. of Aerospace Engineering.
COHERENT STRUCTURES IN TURBULENT BOUNDARY LAYERS
R. F. Blackwell *In* AGARD Turbulent Boundary Layers Jan. 1980 7 p refs (For primary document see N80-27647 18-34) (Grant DAAG29-76-G-0297)
Avail: NTIS HC A17/MF A01

The nature of coherent eddy structures in turbulent boundary layers is examined. The dynamics of turbulent boundary layers are controlled by two different eddy structures. In the intermittent region, the large scale outer structure dominates the flow field and controls the entrainment of nonturbulent fluid. Near the wall, counter-rotating streamwise vortices, with resulting elongated streaks of low speed fluid lying between them, are the predominate eddies. The interaction between these two different eddy structures seems to be the primary means by which turbulent energy is produced. The main features of these characteristic eddies are reviewed and some remaining problems are outlined. M.G.

N80-27671# Cambridge Thermionic Corp., Mass. Dept. of Engineering.
FLOW VISUALIZATION OF TURBULENT BOUNDARY LAYER STRUCTURE
M. R. Head and P. Bandyopadhyay *In* AGARD Turbulent Boundary Layers Jan. 1980 12 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

The results from flow visualization experiments performed using an argon-ion laser to illuminate longitudinal and transverse sections of the smoke filled boundary layer in zero pressure gradient are discussed. Most of the experiments were confined to the range 600 < Re sub theta < 10,000. Results indicate that the boundary layer consists almost exclusively of vortex loops or hairpins, some of which may extend through the complete boundary layer thickness and all of which are inclined at a more or less constant characteristic angle of approximately 45 deg to the wall. Since the cross-stream dimensions of the hairpins appear to scale roughly with the wall variables U sub tau and nu, while their length is limited only by the boundary layer thickness, there are very large scale effects on the turbulence structure. At high Reynolds numbers (Re sub theta = 10,000) there is little evidence of large-scale coherent motions, other than a slow overturning of random agglomerations of the hairpins just mentioned. M.G.

N80-27672# Adelaide Univ. (Australia). Dept. of Mechanical Engineering.
SOME OBSERVATIONS OF THE STRUCTURE OF THE TURBULENT BOUNDARY LAYER
Andrew S. W. Thomas *In* AGARD Turbulent Boundary Layers Jan. 1980 11 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A02/MF A01

Results are presented to describe some measured features of the organized large structure of a turbulent boundary layer. The spanwise correlation scale, the conditional Reynods stress contribution, and the experimentally determined streamline pattern of the large structure are discussed. Correlation and conditional sampling techniques are employed to examine the influence of this structure at the wall. It is found that increased activity at the wall is associated with curved streamlines. This is to be expected if it is a rotational instability that couples the turbulent bursts to the large structure. Author

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see 43 Earth Resources. For related information see also 05 Aircraft Instrumentation, and 19 Spacecraft Instrumentation.

N80-27673 Princeton Univ., N. J.
RESONANT DOPPLER VELOCIMETER Ph.D. Thesis
Micha Zimmermann 1980 230 p
Avail: Univ. Microfilms Order No. 8016470

A technique for visualization and for quantitative measurements of velocity, temperature and pressure of a gaseous flow was developed. These were achieved by shining a single frequency laser beam into a flow which was seeded with an atomic species. The laser was tuned through the absorption frequencies of the seeded species and the absorption profile was detected by observing fluorescence as the atoms relax back to the ground state. The flow velocity was determined by observing the Doppler shift in the absorption frequency. Spectroscopic absorption line broadening mechanisms furnished information regarding the static temperature and pressure of the moving gas. Dissert. Abstr.

N80-27674*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GSFC MARK-2 THREE BAND HAND-HELD RADIOMETER
C. J. Tucker, W. H. Jones, W. A. Kley, and G. J. Sundstrom Jan. 1980 33 p refs Submitted for publication
(NASA-TM-80641) Avail: NTIS HC A03/MF A01 CSCL 14B

A self-contained, portable, hand-radiometer designed for field usage was constructed and tested. The device, consisting of a hand-held probe containing three sensors and a strap supported electronic module, weighs 4 1/2 kilograms. It is powered by flashlight and transistor radio batteries, utilizes two silicon and one lead sulfide detectors, has three liquid crystal displays, sample and hold radiometric sampling, and its spectral configuration corresponds to LANDSAT-D's thematic mapper bands. The device was designed to support thematic mapper ground-truth data collection efforts and to facilitate 'in situ' ground-based remote sensing studies of natural materials. Prototype instruments were extensively tested under laboratory and field conditions with excellent results. Author

N80-27675*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LARGE ANTENNA MULTIFREQUENCY MICROWAVE RADIOMETER (LAMMR) SYSTEM DESIGN

J. Larry King May 1980 33 p refs

(NASA-TM-80685) Avail: NTIS HC A03/MF A01 CSCL 14B

The large Antenna Multifrequency Microwave Radiometer (LAMMR) is a high resolution 4 meter aperture scanning radiometer system designed to determine sea surface temperature and wind speed, atmospheric water vapor and liquid water, precipitation, and various sea ice parameters by interpreting brightness temperature images from low Earth orbiting satellites. The LAMMR with dual linear horizontal and vertical polarization radiometer channels from 1.4 to 91 GHZ can provide multidiscipline data with resolutions from 105 to 7 km. The LAMMR baseline radiometer system uses total power radiometers to achieve delta T's in the 0.5 to 1.7 K range and system calibration accuracies in the 1 to 2 deg range. A cold sky horn/ambient load two point calibration technique is used in this baseline concept and the second detector output uses an integrated and dump circuit to sample the scanning cross-tract resolution cells.

N80-27676# Ballistic Research Labs., Aberdeen Proving Ground, Md.

DYNAMICS OF A LIQUID-FILLED GYROSCOPE: UP-DATE OF THEORY AND EXPERIMENT Final Report

Richard D. Whiting and Nathan Gerber Mar. 1980 52 p refs (DA Proj. 1L1-61102-AH-43)

(AD-A083886; AD-E430411; ARBRL-TR-02221) Avail: NTIS HC A04/MF A01 CSCL 17/7

New comparisons are made between the theory of Stewartson, as modified by Wedemeyer, and existing experimental measurements of the motion of liquid-filled gyroscopes. Errors in previous comparisons are pointed out and corrected, as are some errors in several published presentations of the theory. Because some key parameters were not recorded during the experiments, complete comparisons of theoretical predictions with observed behavior cannot be made. The limited comparisons which can be made show that predicted and measured frequencies of greatest instability of the motion agree to within the experimental error; the growth rates of these frequencies agree to within 10% for Reynolds number greater than 10 to the 4th power, and to within 25% for the lower Reynolds number. GRA

N80-27677# Ballistic Research Labs., Aberdeen Proving Ground, Md.

CAPILLARY FLOWMETERS FOR A ACCURATE, STABLE FLOWS OF GASES

Mark A. Dewilde Mar. 1980 14 p

(DA Proj. 1L1-61102-AH-43)

(AD-A083874; AD-E430407; ARBRL-TR-02230) Avail: NTIS HC A02/MF A01 CSCL 14/2

Capillary flow meters have been used for a number of years now to meter gases into flow systems. This report described a flowmeter/controller that is accurate to 1% and delivers a constant flow independent of delivery pressure between 0-0.10 MP a 0-15 psia. GRA

N80-27678# Naval Postgraduate School, Monterey, Calif.

A 16 LEVEL COLOR DISPLAY SYSTEM FOR TWO DIMENSIONAL ULTRASONIC DATA M.S. Thesis

Eugene L. Moon Dec. 1979 101 p refs

(AD-A083854) Avail: NTIS HC A06/MF A01 CSCL 14/5

A 16 level color display computer program for use with an ultrasonic acoustic imaging system is presented. This display system is the second half of a two part ultrasonic imaging system built at the Naval Postgraduate School. The RAMTEK GX-100A display terminal and a PDP 11/50 digital computer were used as the display system. The software implementation and C language are discussed. Photographs of actual display using an experimental data tape and the computer program are also included. GRA

N80-27679# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.

MATERIALS RESEARCH FOR ADVANCED INERTIAL INSTRUMENTATION. TASK 3: RARE EARTH MAGNETIC MATERIAL TECHNOLOGY AS RELATED TO GYRO TORQUERS AND MOTORS Technical Report, 1 Jul. 1978 - 30 Sep. 1979

D. Das, K. Kumar, and E. Wettstein Oct. 1979 50 p refs

(Contract N00014-77-C-0388)

(AD-A083968; R-1306; TR-2) Avail: NTIS HC A03/MF A01 CSCL 17/7

For inertial applications, high-energy product SmCo5 magnets are required which possess very low flux decay rates, near zero temperature coefficient of magnetization, and thermal expansion coefficient similar to that of beryllium. Concentrated effort has been directed towards achieving and understanding the underlying mechanism of high flux stability. In the ensuing period, efforts will be directed towards temperature compensation and tailoring of thermal expansion along with further studies on stability.GRA

N80-27680# Naval Air Propulsion Test Center, Trenton, N.J. Measurement and Information Systems Dept.

TURBINE FLOWMETERS AND THEIR APPLICATIONS AT THE NAVAL AIR PROPULSION CENTER Final Report

R. E. Oberndorfer Apr. 1980 31 p refs

(W05980000)

(AD-A084181; NAPC-MS-34) Avail: NTIS HC A03/MF A01 CSCL 14/2

At the Naval Air Propulsion Center, it has a specific requirement to make accurate mass flow measurements on the fuel flow of a gas turbine engine to determine the performance characteristics. The problem of acquiring mass flow from the inherent volumetric flow data of a turbine flowmeter is discussed. The development of a universal curve from calibration data is discussed. The unique curve fits for flowmeter, viscosity and specific gravity and their use during on-line data acquisition is described. The accuracy of the final mass flow data and its dependence on the errors associated with viscosity, specific gravity, temperature and frequency measurement is discussed. Some techniques used at NAPC to reduce these errors are described. GRA

N80-27681# National Technical Information Service, Springfield, Va.

HOLOGRAPHIC FLOW VISUALIZATION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1968 - Mar. 1980

Brian Carrigan Apr. 1980 84 p Supersedes NTIS/PS-79/0453; NTIS/PS-78/0351

(PB80-808199; NTIS/PS-79/0453; NTIS/PS-78/0351) Avail: NTIS HC $30.00/MF $30.00 CSCL 20D

A bibliography containing 77 abstracts concerning the use of holographic methods in flow visualization is presented. Research covering flow in wind tunnels, gas lasers, aircraft wakes, aircraft engines, supersonic flow, and shock waves is cited. Most of the techniques involve interferometric holography. GRA

N80-27682# National Technical Information Service, Springfield, Va.

HOLOGRAPHIC FLOW VISUALIZATION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1980

Brian Carrigan Apr. 1980 128 p Supersedes NTIS/PS-78/0352

(PB80-808207; NTIS/PS-79/0454; NTIS/PS-78/0352) Avail: NTIS HC $30.00/MF $30.00 CSCL 20D

Worldwide research on holographic flow visualization is cited. The studies cover techniques, theory, equipment, and various

applications to measure flow in lasers, shock tubes, wind tunnels, and over aerodynamic surfaces. This updated bibliography contains 122 abstracts, 19 of which are new entries to the previous edition. DOE

N80-28036# Joint Publications Research Service, Arlington, Va.
USE OF POLYURETHANE FOAM DEFORMATION SENSOR TO RECORD RESPIRATORY ACTIVITY
V. I. Bredov and V. S. Baranov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14 No. 2, 1980 (JPRS-75654) 8 May 1980 p 134-136 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar/Apr. 1980 p 84-85 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-27683 California Univ., Berkeley.
LASER INDUCED FLUORESCENCE SPECTROSCOPY OF OH IN FLAMES Ph.D. Thesis
Calvin Kwok-Yu Chan 1979 155 p
Avail: Univ. Microfilms Order No. 8014633

A technique using laser-induced fluorescence spectroscopy to make OH concentration measurements in flames was developed. The technique requires modeling the dynamics of the relaxation processes of the OH molecules under excitation and solving the rate equation of every rotational level to obtain the number density distribution in the excited states. The emission spectrum based on this distribution was compared with the fluorescence spectrum to back out the quenching cross section and hence the fluorescence yield of the excited OH molecules through an iterative procedure. Absolute calibration of the OH concentration was made using laser absorption spectroscopy. A linear curve of growth for the fluorescence signal was obtained. Local temperature information was also obtained through the same matching process. Other aspects of laser-induced fluorescence spectroscopy including quenching, saturation, trapping and chemistry effects have also been discussed. The potential of using this technique to make turbulent measurements was assessed. Probability distribution function measurement of OH concentration in turbulent flames was demonstrated.
Dissert. Abstr.

N80-27684 Arizona Univ., Tucson.
OPTICAL PERFORMANCE ANALYSIS OF CO2 LASER FUSION SYSTEMS Ph.D. Thesis
George Nelson Lawrence 1980 164 p
Avail: Univ. Microfilms Order No. 8015595

The components and phenomena which must be considered in the analysis of the CO2 laser fusion system are described. The applicability of ray trace, interferogram reduction, and prior diffraction propagation programs is discussed. The basic structure of the LOTS CO2 laser fusion analysis program is outlined. The general three dimensional complex amplitude description. Methods of treating the nonlinear gain and saturable absorber media are developed. The numerical calculation of near-field diffraction distributions in noncollimated beams and the far-field diffraction distributions in spatial filters and imaging is discussed. Estimates of sampling errors are developed for the case of diffraction from a uniformly illuminated circular aperture for the near and far field. Methods of introducing interferometric data into the calculations are described. Smoothed random wavefronts are used to substitute for components known only by their specification values. Requirements and techniques of construction of these random wavefronts are explored. Capabilities and commands for the LOTS program are presented. A preliminary design of the Antares 100 kilojoule CO2 laser fusion system is analyzed to demonstrate how the LOTS code is used. Dissert. Abstr.

N80-27685 Texas Christian Univ., Fort Worth.
WAVEFRONT REPRODUCTION BY STIMULATED BRILLOUIN AND RAMAN SCATTERING Ph.D. Thesis
Robert Mays, Jr. 1979 93 p
Avail: Univ. Microfilms Order No. 8014213

Experimental investigations were made of the wavefront reproduction process (WFR) by backward stimulated Brillouin scattering (SBS) and backward stimulated Raman scattering (SRS)in CS2 with a linearly polarized ruby pump beam. The experimental studies were carried out as a function of the power pump into the cell, the diameter of the optical waveguide, the length of the optical waveguide, and the frequency shift, between the pump and backscattered beams for both CS2 and C7H8O. Photographic records comparing the pump beam with the backscattered SBS and SRS beams were obtained over several orders of magnitude of exposure and quantitative measurements of percentage of nonreproduced radiation in the backscattered beams were made. In all of the cases studied there was a high degree of replication observed between the SBS and pump beams using both non-Gaussian and near-Gaussian incident laser profiles. In all of the cases studied the efficiency of the WFR process by backward SBS was better than 85% and it improved as the pump intensity was increased and the frequency shift was decreased. Neither the diameter nor the length of the optical waveguides utilized in these experiments appeared to significantly influence the efficiency of the WFR process by backward SBS.
Dissert. Abstr.

N80-27686# Michigan State Univ., East Lansing.
COMPUTER MODELING OF PULSED CHEMICAL LASERS Final Report, 1 Nov. 1978 - 31 Oct. 1979
R. L. Kerber 1 Dec. 1979 283 p refs
(Grant AF-AFOSR-2842-75; AF Proj. 2303)
(AD-A083648; AFOSR-80-0300TR) Avail: NTIS HC A13/MF A01 CSCL 09/2

The goal of this research is to quantify laser pulse energy and intensity on P-branch and rotational lasing transitions and provide data from well-defined experiments for interpretation and analysis of computational studies of HF and DF chemical lasers. A compendium of technical reports and publications on rotational non-equilibrium effects in the HF and DF lasers is presented. Modeling efforts have assessed the sensitivity of laser performance to various kinetic mechanisms. The importance of rotational non-equilibrium is identified and the possible effect of vibrational to rotational energy transfer on P-branch and rotational lasing is considered. GRA

N80-27687# Atomic Weapons Research Establishment, Aldermaston (England).
A MULTIPLE PULSE CO2 TEA LASER FOR USE IN THERMAL BLOOMING STUDIES
T. D. J. Cameron, J. A. McMordie, and R. J. Prosser Mar. 1980 18 p refs
(AD-A083930; AWRE-O-6/80; DRIC-BR73030) Avail: NTIS HC A02/MF A01 CSCL 20/5

The design, performance and operating characteristics of a multiple pulse CO2 TEA laser constructed at AWRE for use in thermal blooming studies is described. Using unstable resonator optics, at the maximum pulse repetition frequency of approx. 10.4 Hz, this laser yielded a good quality output beam of mean power 28 + or - 2 W. GRA

N80-27688# Avco-Everett Research Lab., Mass.
VISIBLE LASER RESEARCH ONE METER DEVICE Interim Report, 1 Jul. 1979 - 28 Feb. 1980
D. W. Trainor and H. Hyman 1980 53 p refs
(Contract N00014-76-C-1032; DARPA Order 3152)
(AD-A084196) Avail: NTIS HC A04/MF A01 CSCL 20/5

Stimulated Raman Scattering Experimental Results are discussed. The pump laser was XeF lambda = 350 nm) and two step conversion to the blue-green spectral region was accomplished using molecular hydrogen and deuterium. Conversion efficiencies were measured and overall conversion from the UV to the blue-green of = 40% is reasonable. GRA

N80-27689# SRI International Corp., Arlington, Va.
FREE ELECTRON LASERS WITH VARIABLE PARAMETER WIGGLERS
Norman M. Kroll, Philip Morton, and Marshall N. Rosenbluth Feb. 1980 165 p refs
(Contract MDA903-78-C-0088; ARPA Order 2504)
(AD-A084323; SRI-JSR-79-01) Avail: NTIS

HC A08/MF A01

A general discussion of free electron lasers with variable parameter wigglers is presented with a view towards their potential for the production of high power optical radiation at reasonable efficiency. The theoretical analysis is based upon a one dimensional relativistic Hamiltonian formulation and is developed in a manner to take advantage of the analogy between the free electron laser process and radio frequency accelerators. Three promising operational modes are identified and analyzed. The first may be thought of as an electron decelerator and is thought to have the most promise for single pass devices. Both oscillator and amplifier configurations are studied. The second is based upon adiabatic trapping and detrapping, intended to reduce the spread in electron energy typically induced by the FEL process. The third is based upon the method of phase area displacement. It has the advantage of wide gain bandwidth and small induced energy spread, and is thought to have the most promise for storage ring applications. Generally speaking, it is found that high peak power is intrinsic to these modes of operation. Potential problems from parasitic oscillations analogous to the stimulated Raman effect are analyzed, and some others arising from transverse inhomogeneity are identified. GRA

N80-27090# Naval Postgraduate School, Monterey, Calif.
COMPUTER PROGRAM FOR THE KINETICS AND POPULATIONS IN A XENON FLUORIDE LASER M.S. Thesis
Lonnie William Cole Dec. 1979 88 p refs
(DARPA Order 3747)
(AD-A084459; NPS69-79-013) Avail: NTIS HC A09/MF A01 CSCL 20/5

To highlight in a qualitative manner the kinetics of an excimer laser, a simple computer model for calculating the species populations in a KrF laser cavity is developed; subsequently a computer program is modified to calculate the population of the different electronic configurations of excited neon present in a XeF laser. When modified, the NRL program accounts for 185 reactions and requires 9.5 minutes of CPU time using the IBM 360/67. The populations obtained are applied to the calculation of the index of refraction in the laser cavity. The phase shift is determined per unit length for two laser wavelengths: one laser wavelength is non-resonance with neon and the other is at resonance. Neon is the dominant specie relative to concentration and within the population distribution the neon ground state dominates by a factor of a million. The calculations show that the ground state neon determines the index of refraction. GRA

N80-27091# Air Force Systems Command, Wright-Patterson AFB, Ohio.
PROJECT GROUP FOR LASER RESEARCH Annual Report 1979
142 p refs
(LA-TR-79-46) Avail: NTIS HC A07/MF A01

The organization and development of the Project Group for Laser Research are discussed. Cooperation of the Group with other scientific and technical institutions is noted. Research in the departments of plasma physics and high power laser development, laser chemistry, and laser spectroscopy is summarized. The isotope selective excitation of UF6 which is of interest in connection with uranium isotope separation requires a laser which can be tuned exactly to an absorption line of the molecule in the region where the wavelength equals 16 micrometers. DOE

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-27092 California Univ., Berkeley.
A STUDY OF ABRASIVE WEAR Ph.D. Thesis
Ambrish Misra 1979 152 p
Avail: Univ. Microfilms Order No. 8014814

The various types of three body abrasive wear are classified. Existing three body abrasive wear testers were examined and a tester to simulate a certain type of three body abrasive wear was designed. With simple modifications the tester can also be used for two body abrasive wear tests. A study of the effect of various variables on two body and three body abrasive wear revealed that many of the results reported in the literature are not strictly valid for two body abrasive wear. The effect of abrasive particle size on wear rate was an explanation based on a preferentially work-hardened layer near the surface due to dislocation tangles and pile-ups is presented to explain this phenomenon. A simple additive wear rule for estimating the abrasive wear damage under field conditions is given along with factors to be considered when selecting materials for abrasive wear applications. Dissert. Abstr.

N80-27093 City Univ. of New York, N. Y.
FORCE BALANCING MACHINES AND OPTIMIZATION OF DYNAMIC RELATIONS FOR PLANAR MECHANISMS Ph.D. Thesis
Stephen J. Tricamo 1980 321 p
Avail: Univ. Microfilms Order No. 8014992

Experimentation showed that a mechanism designed to be fully force balanced exhibits a residual imbalance, brought about by unavoidable manufacturing tolerances and material nonhomogeneities. A theory for a group of devices which allow the complete removal of these residual shaking forces of a four bar linkage and other balanceable mechanisms, is presented and applied to the actual design of a balancing device for a four bar linkage. It was found that the goal of complete elimination of the residual shaking forces was not attainable and that it was necessary to modify the theory such that the best possible reduction in these forces could be obtained. Subsequent experiments, which use minimax as well as least squares approaches and had most successful outcomes, are described. A nonlinear optimization formulation which makes it possible to simultaneously minimize the maximum values of the various dynamic reactions of a four bar linkage while maintaining the ability to prescribe the maximum shaking force, is introduced. Dissert. Abstr.

N80-27094*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RELEASE MECHANISM FOR RELEASING AND REATTACHING EXPERIMENTS ON THE SPACE SHUTTLE
A. V. Clark Jul. 1980 21 p
(NASA-TP-1702; M-301) Avail: NTIS HC A02/MF A01 CSCL 22B

The release mechanism (REM) unlatches an experiment so that it can be moved about inside and outside the shuttle bay by the remote manipulator system (RMS), and then reattaches it to the REM base. Operated from the crew compartment after the RMS has been attached to the experiment, the REM releases the experiment by an electric motor driving a gear train and linkage which extracts four pins from holes in four plates. Electrical connectors on the REM are disengaged by the mechanical action of the structural pins retracting from the plates. When the REM releases the experiment, an unlatched indicator is actuated in the crew compartment, and then the experiment can be moved by using the RMS. To reattach the experiment to the REM, the RMS places the experiment with REM attachment angles against the flat, smooth surface of the REM; then the RMS moves the experiment into position for latchup. Actuation of an electric motor drives the four pins into the four holes in the plates. When fully latched, a switch actuated by the motion of the linkage, shuts the electric motor off and gives an indication to the crew compartment that the REM is latched. A.R.H.

N80-27095*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DYNAMIC ANALYSIS OF NONCONTACTING FACE SEALS
I. Etsion May 1980 40 p refs
(NASA-TM-79294; E-458) Avail: NTIS HC A03/MF A01 CSCL 11A

The dynamic behavior of a noncontacting coned face seal is analyzed taking into account various design parameters and operating conditions. The primary seal ring motion is expressed by a set of nonlinear equations for three degrees of freedom. These equations, which are solved numerically, allow identification of two dimensionless groups of parameters that affect the seal dynamic behavior. Stability maps for various seals are presented. These maps contain a stable-to-unstable transition region in which the ring wobbles at half the shaft frequency. The effect of various

parameters on seal stability is discussed and an empirical expression for critical stability is offered. Author

N80-27696*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE RESPONSE OF TURBINE ENGINE ROTORS TO INTERFERENCE RUBS
Albert F. Kascak 1980 18 p refs Presented at Army Sci. Conf., West Point, N. Y., 17-19 Jun. 1980 Film Supplement number C-294 to this report is available on request from Chief, Management Services Division (5-5), National Aeronautics and Space Administration, Lewis Research Center, 21000 Brookpark Road, Cleveland, Ohio 44135
(NASA-TM-81518; AVRADCOM-TR-80-C-14; E-462) Avail: NTIS HC A02/MF A01 CSCL 21D

A method was developed for the direct integration of a rotor dynamics system experiencing a blade loss induced rotor rub. Both blade loss and rotor rub were simulated on a rotor typical of a small gas turbine. A small change in the coefficient of friction (from 0.1 to 0.2) caused the rotor to change from forward to backward whirl and to theoretically destroy itself in a few rotations. This method provides an analytical capability to study the susceptibility of rotors to rub induced backward whirl problems. L.F.M.

N80-27697*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STRESSES AND DEFORMATIONS IN ELLIPTICAL CONTACTS
Bernard J. Hamrock 1980 19 p refs Lecture presented at Lulea Univ., Sweden, 24 Jul. - 16 Aug. 1980
(NASA-TM-81535; E-488) Avail: NTIS HC A02/MF A01 CSCL 13I

Topics presented deal with defining conformal and nonconformal surfaces, curvature sum and difference, and surface and subsurface stresses in elliptical contacts. Load-deflection relationships for nonconformal contacts are developed. The deformation within the contact is, among other things, a function of the ellipticity parameter and elliptic integrals of the first and second kinds. Simplified expressions that allow quick calculations of the deformation to be made simply from a knowledge of the applied load, the material properties, and the geometry of the contacting elements are presented. L.F.M.

N80-27698*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FULLY FLOODED ELASTOHYDRODYNAMIC LUBRICATED ELLIPTICAL CONTACTS
Bernard J. Hamrock 1980 27 p refs Lecture presented at Lulea Univ., Sweden, 24 Jul. - 16 Aug. 1980
(NASA-TM-81543; E-497) Avail: NTIS HC A03/MF A01 CSCL 13I

Emphasis is on fully flooded, elastohydrodynamic lubricated, elliptical contacts. A fully flooded conjunction is one in which the film thickness is not significantly changed when the amount of lubricant is increased. A brief description of the relevant equations used in the elastohydrodynamic lubrication of elliptical contacts is given. The most important practical aspect of the elastohydrodynamic theory is the determination of the minimum film thickness within the contact. The maintenance of a fluid film of adequate magnitude is an essential feature of the correct operation of lubricated machine elements. The results presented show the influence of contact geometry on minimum film thickness as expressed by the ellipticity parameter and the dimensionless speed, load, and materials parameters. Film thickness equations are developed for materials of high elastic modulus, such as metal, and for materials of low elastic modulus, such as rubber. In addition to the film thickness equations that are developed, plots of pressure and film thickness are presented. These theoretical solutions for film thickness have all the essential features of previously reported experimental observations based on optical interferometry. Correlation between theory and experiments is also presented. L.F.M.

N80-27699*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STARVED ELASTOHYDRODYNAMIC LUBRICATED ELLIPTICAL CONTACTS
Bernard J. Hamrock 1980 23 p refs Lecture presented at Lulea Univ., Sweden, 24 Jul. - 16 Aug. 1980
(NASA-TM-81549; E-507) Avail: NTIS HC A02/MF A01 CSCL 13I

A theoretical study of the influence of lubricant starvation on film thickness and pressure in hard and soft elliptical elastohydrodynamic contacts is presented. From the results for both hard and soft EHL contacts a simple and important dimensionless inlet boundary distance is specified. This inlet boundary defines whether a fully flooded or a starved condition exists in the contact. Furthermore it is found that the film thickness for a starved condition could be written in dimensionless terms as a function of the inlet distance parameter and the film thickness for a fully flooded condition. Contour plots of pressure and film thickness in and around the contact are shown for fully flooded and starved conditions. The theoretical findings are compared directly with results obtained experimentally. Author

N80-27700# New Mexico Univ., Albuquerque. College of Engineering.
THE WAVY MECHANICAL SEAL: THEORETICAL AND EXPERIMENTAL RESULTS Summary Report, 1 Dec. 1978 - 30 Nov. 1979
A. O. Lebeck and L. A. Young Jan. 1980 224 p refs
(Contract N00014-76-C-0071)
(AD-A083933; ME-105(80)ONR-414-1) Avail: NTIS HC A10/MF A01 CSCL 11/1

In this report the results of theoretical and experimental investigations on the effects of waviness on mechanical face seal performance are presented. In previous work it was shown how waviness imposed on a seal face leads to reduced friction and wear while creating only a small leakage in a water seal. It was also shown that the waviness must be moved slowly around the seal ring in order that the effect of waviness remain indefinitely. A test apparatus for measuring the effects of waviness is described. A computer based system is used to record the data and monitor the test. A test procedure is outlined. Results from wavy seal experiments show that waviness reduces seal wear compared to a flat face seal a factor of four to forty and reduces torque a factor of four. Long term tests show that by moving the wave the effect remains indefinitely. As the amount of waviness is increased, friction torque decreases and leakage increases. Wear profiles show that the seal faces have a tilt in addition to waviness. This alters the pressure distribution significantly when compared to the radially parallel wavy faces analyzed previously. Tests using a converging radially tapered seal show that the taper wears away with time. GRA

N80-27701# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Fluid, Lubricants, and Elastomers Branch.
FLUOROALKYLENEETHER SILICATE/VITON GLT BLENDS FOR HYDRAULIC SYSTEM SEALS: SYNTHESIS, BLENDING, AND TESTING Final Technical Report, Sep. 1978 - Mar. 1979
Alan A. Shaffer, Robert E. Cochoy, and William E. Berner Mar. 1980 51 p refs
(AF Proj. 2421)
(AD-A084708; AFML-TR-79-4142) Avail: NTIS HC A04/MF A01 CSCL 11/1

Fluoroalkyleneether silicate (FES) polymers were obtained from the reaction between fluoroether bis-dimethyl carbinols and bis-dimethylamino methyl-vinyl and dimethyl silane derivatives. Peroxide cure reactivity through the pendant vinyl moieties was demonstrated. In an effort to improve the low temperature flexibility of a commercial fluorocarbon elastomer (Viton GLT from DuPont), blends were prepared using the FES materials as an additive co-curing plasticizer. Temperature retraction tests demonstrated an optimum 9 F improvement in low temperature flexibility. O-ring seal evaluations in Freon E6.5 fluid (chew and piston seal tests) demonstrated some seal enhancement and comparable durability in comparison to standard Viton GLT O-rings. GRA

N80-27702# Sonobond Corp., Westchester, Pa.
ULTRASONICALLY ACTIVATED DIFFUSION BONDING FOR FLUIDIC CONTROL ASSEMBLY Final Report
Howard A. Scheetz, Paul L. Coppa, and Janet Devine Dover, N. J. Army Armament Res. And Develop. Command Feb.

1979 161 p refs
(Contract DAAA21-76-C-0186)
(AD-A084658; AD-E400293; ARLCD-CR-79005) Avail: NTIS HC A08/MF A01 CSCL 13/8

Modified ultrasonic metal bonding equipment was used to develop a new fluidic stack assembly process. Ultrasonically activated diffusion bonding was successfully applied to aluminum laminates of different sizes (up to 1 by 1 inch), different foil thicknesses (2, 3, and 5 mils), and different number of layers (up to 18). Bonds were obtained without excessive deformation, within a few seconds of ultrasonic bonding time, on as-received surfaces, with special atmospheres, on commercially prepared etched foil fluidic laminate stacks. Bonds were judged good quality from visual examination of stack surfaces and edges, from electrical resistance measurements made face to face, and from photomicrographic analysis of assembly cross sections. Analysis of the bonding system led to establishment of fundamental bonding parameters and equipment requirements for assembly of larger and thicker stacks. Investigation of the use of increased ultrasonic power for assisting the diffusion bonding of fluidic elements verified the fact that increased areas and/or thickness of laminates can be joined, but that dedicated tooling must be developed to assure the success of the process development. GRA

NBO-27703# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
HYDROLYZED WOOD SLURRY FLOW MODELING
J. Wrathall and Sabri Ergun Nov. 1979 9 p Presented at the Thermochem. Conversion Contractor's Meeting, Rolla, Mo., 7 Nov. 1979
(Contract W-7405-eng-48)
(LBL-10090) Avail: NTIS HC A02/MF A01

The catalytic conversion of hydrolyzed wood slurry to fuel oil is considered. A process to convert Douglas Fir chips into a pumpable fuel at costs comparable to current spot prices for Middle Eastern crude oil was designed. Operating difficulties that have developed at the pilot plant, include the production and handling of a pumpable, nonclogging hydrolyzed slurry as feedstock for a liquefaction process. A flow system was set up to investigate the properties of the hydrolyzed slurry in hopes of acquiring proficiency in control of slurry flow and development of conditions and correlations that will be of general usefulness to the chemical engineering community. Operating directives will be issued based on the research which will be of value in solving some of the problems encountered. DOE

NBO-27704# Gulf Research and Development Co., Chestwick, Pa.
EFFECT OF AMBIENT TEMPERATURE ON VEHICLE EMISSIONS AND PERFORMANCE FACTORS Final Report
R. S. Spindt, R. E. Dizak, R. M. Stewart, and W. A. P. Meyer Sep. 1979 175 p refs
(Contract EPA-68-03-2530)
(PB80-162753; EPA-460/3-79-006A) Avail: NTIS HC A08/MF A01 CSCL 13F

Ambient temperatures are reported to affect automotive emissions and fuel economies since 1966. The results of exhaust emissions (regulated and unregulated) and fuel economies associated with fourteen selected vehicles tested at ambient temperatures ranging from 0F (-18C) to 110F(43C) are presented using the various test procedures. GRA

NBO-27705# National Inst. for Occupational Safety and Health, Cincinnati, Ohio. Div. of Physical Sciences and Engineering.
CONTROL OF PHYSICAL AGENT HAZARDS OF ARC WELDING AND CUTTING
David L. Bartley, William N. McKinnery, Jr., and Kenneth R. Wiegand Sep. 1979 50 p refs
(PB80-164866) Avail: NTIS HC A03/MF A01 CSCL 06J

The ultraviolet radiation from gas tungsten arc welding (GTAW), gas metal (spray arc) welding (GMAW), and plasma arc cutting (PAC) was measured using a micro-computer controlled rapid scan spectroradiometer. Welding of aluminum alloys containing low concentrations of magnesium were found to yield radiation of considerably greater biological activity than nonmagnesium alloys and, at a distance of one meter from the arc, up to a thousand times that of sunlight at the Earth's surface. Magnesium in small concentrations was found to be important to radiation emission owing to the ease of vaporization into the arc and to the existence of magnesium emissions in the ultraviolet. GMAW emission dependencies on process, shielding gas, gap, and magnesium concentration were determined. Ultraviolet radiation and third octave band noise analyses of PAC were also carried out. Preliminary measurements of welders' clothing transmittance were made. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

NBO-27706 Pennsylvania State Univ., University Park.
SAMPLE SIZE DETERMINATIONS FOR SOME RELIABILITY PROBLEMS Ph.D. Thesis
Terry Lee King 1980 71 p
Avail: Univ. Microfilms Order No. 8015809

It is shown that if two or more reliability functions are being considered and these functions are normal or Weibull, then it is not possible to choose one population which has a larger value for the reliability at all values of t. In these cases it is therefore necessary to choose a point, say t^*, at which to draw inferences. Sample sizes are presented for three different settings. In the first setting, sample sizes are given for selecting the population among K normal populations which has the highest reliability at t^*. In the second setting, when a two parameter Weibull distribution is assumed and the experiment is censored on time, the Neyman-Pearson lemma is applied to produce lower bounds on the sample size required to select the most reliable population. In the third setting, again the normal distribution is assumed. Tables giving the power of a one sided hypothesis test are presented for the situation in which the statistic is distributed as a noncentral t random variable under the null and the alternative hypotheses. These tables will aid the experimenter in determining the sample size to be used in an experiment that will result in the construction of a tolerance interval or the variables sampling plan. Dissert. Abstr.

NBO-27707 California Univ., Berkeley.
GRAPHICAL TECHNIQUES IN RELIABILITY THEORY Ph.D. Thesis
Bernard Paul Davis 1979 71 p
Avail: Univ. Microfilms Order No. 8014646

The concept of total time on test is extended to the bivariate case. In the one dimensional situation the failure rate function completely describes the aging characteristics of the underlying life distribution. The bivariate analogue of the failure rate function is the hazard gradient. This is a vector-valued function of two variables and jointly, the two functions in the hazard gradient describe the aging as well as dependence characteristics of the underlying bivariate life distribution. The hazard gradient is studied in detail in the context of some general types of dependence. A bivariate form of the total time on test transform is defined and some of its properties are discussed. Its relationship to the hazard gradient is shown to be similar to that of the one dimensional total time on test transform to the failure rate function. The empirical total time on test and the bivariate total time on test plot are discussed and some asymptotic properties of the empirical transform are presented. A bivariate version of the cumulative total time on test statistic is defined and some possible applications to data analysis are discussed. Finally, the structure of the cumulative total time on test statistic is investigated and some distributional results are presented. Dissert. Abstr.

NBO-27708# Virginia Polytechnic Inst. and State Univ., Blacksburg.
MULTICHARACTERISTIC QUALITY CONTROL: A SURVEY
P. M. Ghare, Y. V. Hui, and D. R. Jensen Mar. 1980 27 p refs
(Grant DAAG29-78-G-0172)
(AD-A083894; ARO-1915194.5-M) Avail: NTIS

HC A03/MF A01 CSCL 12/2

Multicharacteristic quality control is concerned with inspecting the quality of an allotment of items and with monitoring production processes when the quality of an item or the state of a process is determined by a number of observable characteristics. This report reviews procedures currently available for multicharacteristic quality control when the characteristics are either variables or attributes. Attention is given to both location and dispersion parameters in the case of variables. Some limitations of these procedures are noted. GRA

N80-27709# Drexel Univ., Philadelphia, Pa. Dept. of Mechanical Engineering and Mechanics.

GENERALIZED APPROACH TO NEW PROBLEMS IN ULTRASONIC INSPECTION (GANPUI)

Joseph L. Rose and Michael J. Avioli 2 Apr. 1980 98 p refs

(Contract N68335-78-C-1041)

(AD-A083931; NAEC-192-140) Avail: NTIS HC A05/MF A01 CSCL 14/2

Generalized approach to new problems in ultrasonic inspection is detailed. It is an operator-computer interactive scheme involving application of latest techniques in ultrasonic inspection, pattern recognition, and minicomputer technology. GRA

N80-27710# Dosmatics, Inc., State College, Pa.

AN INVESTIGATION OF A STATISTICAL PROCEDURE FOR MONITORING TWO-SAMPLE LIFE TESTS

Leslie A. Kalish and Dennis E. Smith Apr. 1980 25 p refs

(Contract N00014-75-C-1054)

(AD-A084041; TR-106-9) Avail: NTIS HC A02/MF A01 CSCL 14/2

A statistical procedure is described for comparing two lifetime distributions when the data is reviewed repeatedly over time. The procedure provides the capability of early decision while maintaining both a fixed significance level and fixed maximum length for the entire experiment. The effects which staggered entry, number of looks at the data and maximum test length have on power and expected test length are discussed. An application is made to a bearing fatigue-life test. GRA

N80-27711# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.

X-RAY TECHNIQUES FOR THE MEASUREMENT OF RESIDUAL STRESSES IN THE REAL WORLD

Jerome B. Cohen 8 Apr. 1980 14 p refs

(Contract N00014-75-C-0580; NR Proj. 031-733)

(AD-A083796; TR-27) Avail: NTIS HC A02/MF A01 CSCL 14/2

The principles of the X-ray method of measuring residual stresses are reviewed, with special emphasis on the latest developments in both procedures and equipment. Rapid in-the-field measurements are now being performed. It is possible to obtain stress gradients without layer removal and to obtain the entire stress tensor (not just the surface stress). GRA

N80-27712# Houston Univ., Tex.

INTERDISCIPLINARY STUDY ON ADVANCED NDI TECHNIQUES Interim Report, 1 Sep. 1978 - 30 Nov. 1979

Auguste B. El-Kareh, Stuart Long, C. Gerald Gardner, and Kamal Salama Jan. 1980 99 p refs

(Grant AF-AFOSR-3457-77; AF Proj. 2307)

(AD-A084242; AFOSR-80-0331TR) Avail: NTIS HC A05/MF A01 CSCL 14/2

In Part 1 of this report - Development of an ultrasonic method for nondestructive evaluation of residual stresses - a measure of the temperature dependence of the ultrasonic velocity is used to evaluate the state of internal stress in a solid. In Part 2 - Electromagnetic methods for nondestructive evaluation - a study is made on quantitative low frequency eddy current testing on nonferromagnetic structural metals and/or microwave testing of nonmetalic materials. GRA

N80-27713# National Bureau of Standards, Washington, D.C. National Measurement Lab.

DEFECT CHARACTERIZATION AND DIMENSIONING OF CRACKS IN WELDS BY THE ULTRASONIC DIFFRACTION METHOD

S. Golan Mar. 1980 27 p refs

(PB80-161755; NBSIR-80-1983) Avail: NTIS HC A03/MF A01 CSCL 13C

The possibility of applying an ultrasonic diffraction method for dimensioning of crack-line defects in welds was investigated. A feasibility study was carried out and optimum test conditions were established using a series of test specimens with narrow slits. A series of welded specimens with in-weld cracks were tested. The possibility of using a quantitative diffraction technique for nondestructive examination of pipeline welds in field conditions is discussed. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-27714 Purdue Univ., Lafayette, Ind.

A UNIFIED NUMERICAL APPROACH FOR THERMALLY INDUCED STRESS WAVES Ph.D. Thesis

Hsu-Chao Chen 1979 159 p

Avail: Univ. Microfilms Order No. 8015437

A simple procedure is proposed for modifying an existing computer code to extend its capability to solve problems which involve heat expansions and thermomechanical coupling effects. The procedure is based on a unified variational formulation which introduces the concept of heat displacement and a compatible generalized displacement vector to represent the mechanical response, the thermal response, and their coupling effects. To illustrate the applications of the concept, a plane-stress/plane-strain analysis program was modified and numerically verified examples for uniaxial stress waves, known as the Danilovskaya's problems in thermoelasticity, biaxial stress waves generated by boundary heating or a concentrated heat source were studied. The latter simulates a cutting or a welding problem for thin plates. Numerical data were compared with the analytical solutions are available. Emphasis was focused on the significance of the thermomechanical coupling effects. Dissert. Abstr.

N80-27715 Cornell Univ., Ithaca, N. Y.

***INELASTIC ANALYSIS AND DESIGN OF COLD-FORMED* STEEL BEAMS WITH STIFFENED COMPRESSION FLANGES Ph.D. Thesis**

Muzaffer Yener 1980 403 p

Avail: Univ. Microfilms Order No. 8015753

On the basis of test results on specimens formed from mild structural steel sheets having a yield stress of approximately 37 ksi it is found that ultimate compressive strain mainly depends on: (1) the compression flange slenderness ratio, w/t, and (2) the moment of gradient. A limiting case of moment gradient is defined and beams are divided into two categories. Accordingly, beams subjected to moment gradients higher than the specified limit are classified as members under moment gradient and those with gradients lower than the specific limit as beams under uniform moment. The compressive strain failure criterion is conveniently and conservatively expressed in terms of only one parameter, w/t, for each of the two categories of beams. The failure criterion is verified experimentally for high strength structural steel beams having a yield stress of 56 ksi subjected to moment gradient and uniform moment. In addition, restrictions on the web slenderness ratio, h/t, of sections designed in accordance with the proposed compressive strain failure criterion are provided by modifying the procedure followed in determining such ratios for hot rolled sections. Dissert. Abstr.

N80-27716 Illinois Univ. at Chicago Circle, Chicago.

SERVICEABILITY AND RELIABILITY ANALYSIS OF PARTIALLY PRESTRESSED CONCRETE BEAMS Ph.D. Thesis

Amnuayporn Siriaksorn 1980 495 p

Avail: Univ. Microfilms Order No. 8014233

The serviceability and reliability analysis of partially pre-stressed concrete beams is addressed. An accurate and rational

method of analysis is developed for partially prestressed concrete beams based on equilibrium, compatibility, and constitutive relations for both the cracked and uncracked sections. Direct equations are derived for the stresses and strains in the materials taking into account the change in the prestressing force due to the application of loads. A design procedure based on satisfying ultimate strength requirements and serviceability criteria is proposed. In addition, a reliability based design model for partially prestressed concrete beams is proposed. It is essentially based on the method called first order second moment which requires the knowledge of only the mean and variance of the distributions of the resistance and load. The reliability index beta of partially prestressed concrete beams at six serviceability limit states is evaluated. The six limit states considered are: maximum crack width, short and long term deflection and fatigue stress ranges in the concrete, the reinforcing steel and the prestressing steel. The effects of many parameters on the observed values of the reliability index beta are analyzed. Dissert. Abstr.

N80-27717 *California Univ., Berkeley.*
NONLINEAR GEOMETRIC, MATERIAL AND TIME DEPENDENT ANALYSIS OF REINFORCED AND PRESTRESSED CONCRETE SLABS AND PANELS ***Ph.D. Thesis***
Johannes VanGreunen 1979 281 p
Avail: Univ. Microfilms Order No. 8014915

A numerical method of analysis is developed to trace the quasi-static response of reinforced and prestressed concrete slabs and panels under short time and sustained load conditions. Time-dependent effects due to load history, temperature history, creep shrinkage and aging of concrete and stress relaxation in prestressing steel are incorporated. The load-deflection history of such structures through the elastic, inelastic and ultimate ranges is calculated. The ultimate failure of these structures due to in-plane membrane plus bending effects is then predicted considering local failures in steel and concrete along with the deterioration of the structural stiffness due to progressive cracking. A finite element tangent stiffness formulation, coupled with a time step integration scheme, is developed to analyze reinforced and prestressed concrete slab and panel structures. Within a time step, an incremental load procedure with an iterative approach to obtain and equilibrium position of the structure for each load increment, is adopted to trace the nonlinear behavior of such structures. Dissert. Abstr.

N80-27718 *California Univ., Los Angeles.*
STRUCTURAL AND ACOUSTIC RESPONSE OF SUBMERGED SHELLS OF REVOLUTION ***Ph.D. Thesis***
Allen John Bronowicki 1980 114 p
Avail: Univ. Microfilms Order No. 8015957

A reduction in dimensionality of the problem is achieved through a decomposition of motion into circumferential harmonics. The acoustic relation is thus represented as an integral equation defined along the shell meridian. This relation, derived on the basis of a Green's function technique featuring toroidal wave functions, is applicable to surfaces having arbitrary meridianal shape, including corners. In order to assure uniqueness of solution, interior equations are appended to the set of surface integral equations. The concept of an acoustic element, with meridianal pressure variation determined by the response at a number of surface pressure nodes, is introduced. The structure is represented in terms of an assemblage of conical frustum shell elements having either two or three nodal rings. The capability of representing prestress effects is included in these elements. The fluid-structure interaction relation is consistently developed on the basis of modal degrees of freedom. The final product is an accurate, efficient scheme to predict structural response, and surface and exterior pressure fields. Dissert. Abstr.

N80-27719*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF ELASTIC AND ELASTIC-PLASTIC STRUCTURAL ANALYSES FOR COOLED TURBINE BLADE AIRFOILS
Albert Kaufman Jul. 1980 15 p refs
(NASA-TP-1679; E-241) Avail: NTIS HC A02/MF A01 CSCL 20K

Elastic plastic stress strain states in cooled turbine blade airfoils were calculated by three methods for the initial takeoff transient of an advanced technology aircraft engine. The three analytical methods compared were a three dimensional elastic plastic, finite element analysis, a three dimensional, elastic, finite element analysis, and a one dimensional, elastic plastic, beam theory analysis. Structural analyses were performed for eight cases involving different combinations of mechanical and thermal loading on impingement cooled airfoils with and without leading edge film cooling holes. The von Mises effective total strains at maximum takeoff computed from the elastic and elastic plastic finite element analyses agreed with 9 percent for rotating airfoils and 28 percent for stationary airfoils with the elastic results on the conservative side. Author

N80-27720*# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
INSTRUCTIONS FOR THE USE OF THE CIVM-JET 4C FINITE-STRAIN COMPUTER CODE TO CALCULATE THE TRANSIENT STRUCTURAL RESPONSES OF PARTIAL AND/OR COMPLETE ARBITRARILY-CURVED RINGS SUBJECTED TO FRAGMENT IMPACT
Jose J. A. Rodal, Susan E. French, Emmett A. Witmer, and Thomas R. Stagliano Dec. 1979 38 p refs
(Grant NGR-22-009-339)
(NASA-CR-159873; ASTL-MR-154-1) Avail: NTIS HC A03/MF A01

The CIVM-JET 4C computer program for the 'finite strain' analysis of 2 d transient structural responses of complete or partial rings and beams subjected to fragment impact stored on tape as a series of individual files. Which subroutines are found in these files are described in detail. All references to the CIVM-JET 4C program are made assuming that the user has a copy of NASA CR-134907 (ASRL TR 154-9) which serves as a user's guide to (1) the CIVM-JET 4B computer code and (2) the CIVM-JET 4C computer code 'with the use of the modified input instructions' attached hereto. L.F.M.

N80-27721*# SRI International Corp., Menlo Park, Calif.
DEVELOPMENT AND APPLICATION OF A COMPUTATIONAL SHEAR BAND MODEL ***Final Report, 7 Apr. 1976 - 7 Apr. 1977***
D. C. Erlich, L. Seaman, D. A. Hockey, and D. R. Curran Mar. 1980 123 p *refs*
(Contract DAAD05-76-C-0762)
(AD-A084029; AD-E430412; ARBRL-CR-00416) Avail: NTIS HC A06/MF A01 CSCL 12/1

A computational shear band model has been developed and used to predict the fragmentation response of explosively-loaded cylinders and munitions. The model is based on the physical processes occurring in the material that lead to fragmentation, as observed in experiments in which the fragmentation process was stopped at various stages of development. Good agreement was obtained between measured and computed fragment size distributions for two widely different steels, which suggests that the model can be used to predict the effects of variation of geometry, strain rate, and internal pressure on the fragmentation yield of munitions. In addition, fragments of long-rod penetrators of steel and a tungsten-7Ni-3Fe alloy were examined metallographically to establish the failure modes. The observations suggest that shear banding is a principal mode of penetrator failure. Computational simulations of a plate impacting on edge another plate at various oblique angles were performed using the two dimensional wave propagation code TROTT with the BFRACT fracture model. The results showed the distribution of shear, compression, and bending stresses in the projectile and indicated the regions where tensile fracture of shear banding might occur. GRA

N80-27722*# Pacific-Sierra Research Corp., Santa Monica, Calif.
SURVEYS OF HIGH-PRESSURE EFFECTS IN SOLIDS ***Final Report, 21 May - 30 Sep. 1979***
M. Sparks, L. J. Sham (Univ. of Calif. at La Jolla, San Diego), and M. Ross (Univ. of Calif., Lawrence Livermore Lab., Livermore) Nov. 1979 91 p *refs*
(Contract MDA903-79-C-0395)
(AD-A083728; PSR-931) Avail: NTIS HC A05/MF A01 CSCL 20/11

The density-functional formalism is used as the framework

within which to assess previous calculations and to suggest new avenues of research. As a result of the study, we judge that significant results should be obtained from theoretical high-pressure-physics investigations at one of three levels of sophistication: the Gordon-Kim-Boyer scheme with our suggested modifications; use of the exchange-correlation potential in the local-density approximation in such an accurate band-structure calculation as the augmented-plane-wave, Korringa-Kohn-Rostoker, or linear-combination-of-muffin-tin-orbital methods; or a complete calculation of the electron dynamics in the local-density approximation, which would also be useful in calculating the phonon spectrum. This approach should yield good results for the equation of state, which is the required basis for studies of dynamic and nonlinear effects, structural transitions in insulators and semiconductors (possibly providing a microscopic understanding of the successful ionicity scale of Phillips), simple insulator-metal transitions, polymorphic transitions in metals, and mixed-valence salt transitions. The state of the art in experimental and theoretical high-pressure physics research is surveyed in the context of recent studies on iodine, xenon, and cesium. Ultrahigh-pressure methods now under development are also reviewed. GRA

N80-27723# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.

STRESS SINGULARITY AT THE VERTEX OF A FLAT WEDGE-SHAPED CRACK BY A VARIABLE METHOD

M. A. Hussain, B. Noble, and S. L. Pu Jan. 1980 34 p refs

Presented at the ASME-CSME Appl. Mech./Bioeng. Conf./Fluid Eng. Conf., Niagara Falls, N.Y., 18-20 Jun. 1979 and the 2d MACSYMA User's Conf., Washington, D.C., 20-22 Jun. 1979 *Submitted for publication*

(DA Proj. 1L1-61102-H-60)

(AD-A083871; AD-E440064; ARLCB-TR-80002) Avail: NTIS *HC A03/MF A01 CSCL 20/11*

Three dimensional elasticity problems are generally complex. In this paper we present the analysis for the stress singularity at the apex of a three dimensional, flat, wedge-shaped crack under general loadings. The problem is reduced to a set of coupled dual integral equations. Because of the complexity they are not amenable to a closed form solution. A variational method is developed to handle such problems. The physical interpretation of the results is also presented. GRA

N80-27724# Army Armament Research and Development Command, Aberdeen Proving Ground, Md.

FREE VIBRATIONS OF A CONCENTRIC CIRCULAR CONICAL BEAM WITH A CONCENTRIC CIRCULAR CYLINDRICAL BORE

Rurik K. Loder Feb. 1980 37 p refs

(DA Proj. 1L1-61102-AH-43)

(AD-A083292; AD-E430396; ARBRL-TR-02216) Avail: NTIS HC A03/MF A01 CSCL 19/6

An analytical solution describing the free transverse vibration of a concentric circular conical tube with a concentric circular cylindrical bore has been derived for a variable domain which is characteristic for ballistic tubes. Eigenvalues and eigenvectors are discussed for a particular set of boundary conditions. GRA

N80-27725# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Missile Structures Directorate.

STRESS INTENSITIES AROUND TRANSVERSE SURFACE FLAWS IN CYLINDRICAL SHELLS BY PHOTOELASTIC STRESS FREEZING

John A. Schaeffel, Jr. 1 Oct. 1979 48 p refs

(AD-A083073; DRSMI/RL-80-1) Avail: NTIS *HC A03/MF A01 CSCL 14/5*

This report documents a set of seven tests for the determination of K sub I stress intensity factors for isotropic cylinders with transverse part-circular cracks loaded in combined uniaxial extension and internal pressure. Part-circular cracks were machined into birefringent Hysol CPS-4290 photoelastic cylinders. The cylinders were then subjected to combined loading while in a stress freezing cycle. Slices of the cracks were made at various angles and analyzed with a photoelastic polariscope. A least-squares curve fit of the photoelastic data was used to generate K sub I stress intensity factors. K sub I data are plotted versus slice angle into the crack for various crack parameters. The results of the tests were compared with the results of previous tests in which the cylinders were loaded in either pure uniaxial tension or internal pressure. GRA

N80-27726# Delaware Univ., Newark. Applied Mathematics Inst.

A BOUNDARY LAYER THEORY FOR THE ANISOTROPIC PLATE Interim Report

R. P. Gilbert and M. Schneider Mar. 1980 29 p refs

(Grant AF-AFOSR-2879-76)

(AD-A083265; AFOSR-80-0297TR; TR-71A) Avail: NTIS *HC A03/MF A01 CSCL 20/11*

To our knowledge the results of the pioneering paper on the boundary layer theory for plates by K. O. Friedrichs and R. F. Dressler have not been extended to anisotropic plates. Yet the basic conclusion of the above paper, namely that the equations of the three dimensional isotropic elasticity can be split into two independent systems seems to have been accepted by some authors to include also the case of anisotropic elasticity. While this happens to be true it is by no means obvious as the following presentation illustrates; hence, we believe our providing a detailed analysis of the orthotropic plate will be of interest to researchers in the field of composite materials and laminates. GRA

N80-27727# Lockheed Missiles and Space Co., Palo Alto, Calif.

DYNAMIC INSTABILITY OF AN ELASTIC CYLINDRICAL SHELL EXCITED BY A TRANSIENT ACOUSTIC WAVE *Interim Report, 14 Nov. 1977 - 12 Jul. 1979*

T. L. Geers and C. L. Yen 12 Jul. 1979 61 p refs

(Contract DNA001-78-C-0029)

(AD-A083338; AD-E300740; LMSC/D87676; DNA-5026Z)

Avail: NTIS HC A04/MF A01 CSCL 20/11

Governing equations are developed for the dynamic instability of an infinite, elastic, circular cylindrical shell submerged in an infinite fluid medium and excited by a transverse, transient acoustic wave. These equations derive from circumferential Fourier series decomposition of the field quantities appearing in appropriate energy functionals, and from application of the 'residual potential formulation' for rigorous treatment of the fluid-structure interaction. Extensive numerical results are presented that provide understanding of the phenomenology involved and permit evaluation of the 'doubly asymptotic approximation' for treatment of the fluid-structure interaction. GRA

N80-27728# Naval Research Lab., Washington, D. C. Composite Materials Branch.

PLASTIC DEFORMATION AND DUCTILE FRACTURE AT AN ANGLE SLIT IN A SHEET UNDER TENSION Final Report, 1977 - 1979

S. C. Sanday and O. Richmond (U.S. Steel Research Lab., Monroeville, Pa.) 17 Mar. 1980 20 p refs

(RR0220441)

(AD-A084564; AD-E000409; NRL-8391) Avail: NTIS *HC A02/MF A01 CSCL 11/6*

A theoretical solution is obtained for the growth of narrow plastic zones and for the initiation of ductile fracture at the ends of an angled slit in a metal sheet under remote uniform tension. The theoretical model assumes two distinct regions: narrow plastic zones at the ends of the slit caused by necking of the sheet, and a surrounding elastic region. The direction of the narrow plastic zones is assumed to be normal to the remote tension regardless of the slit angle. The length of the plastic zones is assumed to be governed by Dugdale's hypotheses of yield stress attainment along the plastic zone-elastic region boundary and continuity of stress at the end of the plastic zone. Finally, fracture initiation is postulated to occur at the ends of the slit when the ratio of slit opening displacement to plate thickness attains a critical value representative of the material ductility. Experimental results on hard-rolled copper sheets support the assumptions and closely match the predicted results. GRA

N80-27729# Maurer Engineering, Inc., Houston, Tex.

BENDING STRESS AND FREQUENCY CALCULATIONS FOR THE BEARING-PACK SHAFT

Jeff Barnwell and Don W. Dareing Apr. 1980 33 p

(Contract EY-76-C-04-0789)

(SAND-80-7030) Avail: NTIS HC A03/MF A01

The bearing-pack shaft investigation was conducted to analyze bending and cycle fatigue stresses and resonance. The bending stresses produced were considered to be minimal, and the cycle fatigue stress was less than the material's endurance level. Resonating frequencies were estimated to be sufficiently high to preclude problems. DOE

N80-27730# National Technical Information Service, Springfield, Va.

STRESS CRACK PHENOMENA. CITATIONS FROM THE NTIS DATA BASE Progress Report, Mar. 1979 - Feb. 1980

Guy E. Habercom, Jr. Apr. 1980 178 p Supersedes NTIS/PS-79/0270; NTIS/PS-78/0149 (PB80-807886; NTIS/PS-79/0270; NTIS/PS-78/0149) Avail: NTIS HC $30.00/MF $30.00 CSCL 20K

Stress analyses of various materials in which cracks are generated are considered. Stress corrosion, fracture mechanics and crack propagation are included. This updated bibliography contains 171 abstracts, all of which are new entries to the previous edition. GRA

N80-27731# National Technical Information Service, Springfield, Va.

STRESS CRACK PHENOMENA. CITATIONS FROM THE NTIS DATA BASE Progress Report, Feb. 1978 - Feb. 1979

Guy E. Habercom, Jr. Apr. 1980 205 p

(PB80-807878) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 20K

Research on the stress corrosion cracking of reactor materials, pressure vessels, and other structures made of high strength steels and other alloys, prestressed concretes, and ceramic materials is cited. Methods for stress analysis and nondestructive investigations of crack propagation, and metal fatigue are included. This updated bibliography contains 194 abstracts, none of which is new to the previous edition. A.R.H.

42 GEOSCIENCES (GENERAL)

N80-27732*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

GEOID ANOMALIES IN THE VICINITY OF SUBDUCTION ZONES

David C. McAdoo May 1980 46 p refs Submitted for publication

(NASA-TM-80678) Avail: NTIS HC A03/MF A01 CSCL 08E

The regional geoid of the southwest Pacific is matched reasonably well by results from a model of the upper mantle density structure (including slabs) associated with subduction zones of the region. Estimates of the geoid are obtained from Geos-3 and Seasat radar altimeter data. These data are very well suited to the task of detecting intermediate wavelength (600-4000 km) geopotential variations. Actually, subducting slabs can be expected to produce primarily intermediate and longer wavelength variations. Gravimetric profiles across trench/island arc complexes resolve primarily short wavelengths. The model represents subducting slabs as thin surfaces of anomalous mass per unit area. These surfaces are positioned using published seismicity results which detail the configuration of the Benioff zones. Crustal effects are ignored. Effects due to the contrast between the young thermal lithosphere of the behind-arc regions (marginal basins) and the older lithosphere seaward of the trench are modelled. Results indicate that the New Hebrides slab possesses an average areal density anomaly of about 300,000 gm/sq cm. This is about three times that which is estimated for the Tonga-Kermadec slab. Additional modelling suggests that slabs worldwide may be an important source of large, long wavelength gravity highs; i.e., they may contribute substantially to geopotential power of harmonic degree as low as three or four up to twenty or more. Author

N80-27733# European Space Agency, Paris (France). Dept. of Application Programmes.

ON CLIMATOLOGY, HYDROLOGY, ATMOSPHERIC RESEARCH AND METEOROLOGY (CHARM) FROM SPACE

T. D. Guyenne, ed. Feb. 1980 220 p refs Partly in ENGLISH and FRENCH Proceedings of ESA Workshop on CHARM, Ajaccio, France, 12-16 Nov. 1979 Sponsored in part by Comm. of European Communities Original contains color illustrations (ESA-SP-150) Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

Various aspects of the global environment are considered as well as different spaceborne techniques for monitoring these phenomena. Climate and climate modeling are highlighted as well as radiation and radiation processes. The Earth's hydrosphere and cryosphere are covered along with atmospheric structure and composition. Reviews of meteorological research and recently developed space techniques for remote sensing are included. For individual titles, see N80-27734 through N80-27760.

N80-27734# World Meteorological Organization, Geneva (Switzerland).

CLIMATE AND CLIMATE MODELING Final Report c47

B. W. Boville *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 14-18 (For primary document see N80-27733 18-42)

Avail: NTIS HC A10/MF A01

The problems of monitoring global climate and assessing climatic trends are reviewed. The use of satellite observations in the development of mathematical climatic models is considered. Various international data collection programs are cited. Numerical weather prediction is emphasized. In relation to man and his impact on the global environment, the problem of fluctuations in the level of atmospheric CO2 is treated. In conclusion, data requirements regarding climate modeling are specified.

Author (ESA)

N80-27735# Cologne Univ. (West Germany). Inst. for Geophysics and Meteorology.

RADIATION BALANCE AND RADIATION PROCESSES Final Report c46

E. Raschke *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 19-27 refs (For primary document see N80-27733 18-42)

Avail: NTIS HC A10/MF A01

In an attempt to quantify the primary energy source (solar radiation) for all circulation processes within the Earth-atmosphere-ocean system, satellite sounding to determine net radiation flux is proposed. The role of cloud cover in modifying radiation fluxes is emphasized. Observational requirements in measuring radiation budget components and radiation processes, such as energetics and optical properties, are outlined in terms of setting up numerical models. In conclusion, a satellite instrument package, consisting of a pyrheliometer, a pyranometer, a pyradiometer, and a scanning radiometer, is recommended. Author (ESA)

N80-27736# Kiel Univ. (West Germany). Inst. for Marine Research.

THE EARTH'S HYDROSPHERE AND CRYOSPHERE Final Report c46

W. Krauss *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 28-34 (For primary document see N80-27733 18-42)

Avail: NTIS HC A10/MF A01

The role of upper ocean circulation as a critical element in models of climatic change on the scale of weeks or decades is discussed. Emphasis is placed on the sea surface temperature as the most important quantity for climate studies, because it controls the transfer of thermal energy from the ocean to the atmosphere. It is proposed that key ocean parameters be monitored from space. Instrumentation considered includes satellite-borne altimeters, scatterometers, scanning multichannel microwave radiometers, and infrared radiometers. Both Oceanographic and ice measurements are covered. Author (ESA)

N80-27737# British Meteorological Office, Bracknell (England).

ATMOSPHERIC STRUCTURE AND COMPOSITION Final Report c46

K. Stewart *In* ESA On Climatol., Hydrol., Atmospheric Res.

and Meteorol. (CHARM) from Space Feb. 1980 p 35-38 (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

The practical importance of stratospheric research, particularly regarding changes in ozone levels, is discussed. In the field of atmospheric structure and dynamics a lack of data on stratosphere troposphere interactions is identified. Emphasis is placed on the mechanisms whereby materials (water vapor, aerosols, pollutants) are transferred from stratosphere to troposphere and distributed within the stratosphere. In terms of constructing numerical models of these transport phenomena, observational requirements are established. Satellite observation in conjunction with ground-based sounding is suggested. Author (ESA)

N80-27738# Servizio Meteorologico dell'Aeronautica Militare (Italy).

METEOROLOGICAL RESEARCH Final Report c47

B. Bizzarri *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 39-43 (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

The collection and processing of meteorological data is examined in terms of optimizing data analysis. Three data categories are discussed: (1) data for numerical weather prediction; (2) imagery and products from image processing; and (3) data on transport mechanisms in the atmosphere. In conclusion, improvement in satellite data processing is called for. As for atmospheric dynamics, refinement of vertical temperature and humidity sounding techniques, refinement in wind determination, and development of techniques for surface pressure measurements are seen as necessary. Author (ESA)

N80-27739# Centre National de la Recherche Scientifique, Paris (France). Lab. de Meteorologie Dynamique.

SPACE TECHNIQUES Final Report c47

A. Bernir *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 44-48 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

A review of meteorological parameters significant to climatic research is followed by a state of the art examination of measurement techniques. Parameters include radiation budget, cloud properties, and ocean as well as ice data. Also of interest are pressure, wind, temperature, and moisture fields. Data collection techniques include optics, such as lidar, passive interferometry and stereoscopic measurement, as well as passive microwave radiometry and active microwave techniques.
Author (ESA)

N80-27740# European Centre for Medium-Range Weather Forecasts, Reading (England).

ATMOSPHERIC MODELS c46

A. Wim-Nielsen *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 51-62 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

The multitude of atmospheric models presently in existance for purposes of prediction on a regional, hemispheric, and global scale, and for the purpose of simulation of the atmospheric general circulation and climate are briefly described. A global prediction model is considered in detail to illustrate the data requirements for prediction and simulation with a model incorporating energy sources and sinks. The use of atmospheric models in climate research is discussed, illustrating the limitations in various models due to the lack of ability to model the various parts of the climatic system. Author (ESA)

N80-27741# Max-Planck-Institut fuer Meteorologie, Hamburg (West Germany).

STOCHASTIC PROCESSES IN THE ATMOSPHERE-OCEAN SYSTEM c46

K. Herterich *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 63-65 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

Examples of stochastic processes in the atmosphere-ocean system are given and their relation to climate is mentioned. In the case of sea surface temperature (SST) anomalies the technique of inverse modeling (a method of fitting models to stochastic data) is described. The results of the modeling lead to a redefinition of the data requirements. For climatic studies the data should be of global coverage and of long duration in time (decades). Specification of data resolution is also considered. Results show that for modeling SST anomalies the necessary resolution is serveral degrees in longitude and latitude, a few weeks for the time step, and 1/10 C for the precision in temperature.
Author (ESA)

N80-27742# Centre National de la Recherche Scientifique, Grenoble (France). Lab. de Glaciologie.

ICE SHEETS, GLACIERS, AND CLIMATE c47

L. Lliboutry *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. Res. (CHARM) from Space Feb. 1980 p 67-71 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

Main problems of glacier and ice sheet dynamics are reviewed. A correlation between mass balances and meteorological factors is given. The importance of unusual synoptic situations or unusual sea ice cover in June-July-August is pointed out (e.g., quaternary ice sheets may have started on shallow seas). Results show that the thickness of an ice sheet of given width is much more sensitive to mass balance and air temperatures than often assumed. Spatial geodesy is suggested as useful to check numerical calculations of flow, but can give altitude changes only in some special areas. Author (ESA)

N80-27743# Universite des Sciences et Techniques de Lille (France). Lab. d'Optique Atmospherique.

RADIATIVE TRANSFER IN THE CLOUDY AND DUSTY ATMOSPHERE c46

J. Lenoble *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 75-81 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

The transfer of radiation in a scattering atmosphere is briefly reviewed considering the possible approximations and parametrizations. Cloudiness is the main factor governing the planetary radiation balance; climate models should allow for cloud radiation interactions to be properly included. Results are shown concerning the influence of various cloud parameters. Aerosols have a more subtle influence as their role is much weaker, but thier variations can induce local or global climate variations. The need for an improvement in knowledge on aerosol parameters is underlined. Finally, a strategy for both cloud and aerosol radiation studies is proposed. Author (ESA)

N80-27744# Innsbruck Univ. (Austria). Inst. fuer Meteorologie und Geophysik.

ENERGY TRANSPORT IN THE EARTH-ATMOSPHERE SYSTEM AND THE RADIATION BALANCE c46

H.-J. Bolle and P. Speth (Cologne Univ.) *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 83-89 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

The conversion of absorbed short wave energy to infrared radiation emitted to space provides the driving force for large scale transport in the atmosphere-ocean system, which determines the average climate conditions on Earth. The response of the atmosphere and of the oceans to the variations in the energy input is a 'meteorological noise' which generates by interference climate variations. The kind of variability which can be expected depends at least partly on the distribution of energy sources and sinks in the atmosphere-land-ocean-system itself and their variability. The many processes and feedback mechanisms involved are reviewed. As manifestation of the sum of these processes, is the radiation balance at the top of the atmosphere.
Author (ESA)

N80-27745# Physikalisch-Meteorologisches Observatorium, Davos (Switzerland).

THE SOLAR CONSTANT AND ITS SPECTRUM c92

C. Froelich *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 91-94 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

The present status of knowledge of the solar constant and the solar spectral irradiance is described. The most probable value of the solar constant is 1366 + or - 5W/sq m. As to a possible variability no conclusions can be drawn. Accurate determinations over extended periods of time are therefore recommended. The accuracy of the solar spectral irradiance in the energetic bulk part of the spectrum is poor, partly due to instrumental and calibration problems. Recommendations to improve this situation are given. Author (ESA)

N80-27746# Institut Royal Meteorologique de Belgique, Brussels.
SAMPLING PROBLEMS AND RADIATION BUDGETS: DATA REQUIREMENTS [PROBLEMES D'ECHANTILLONAGE ET BILANS RADIATIFS: LEUR PROBLEMATIQUE] c48

D. Crommelynck *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 95-102 refs In FRENCH; ENGLISH summary (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

How knowledge of the different radiation budgets with their components is largely dependent on space time sampling of the radiation field of the Earth-atmosphere system is shown. Whichever instrumental approach is adopted (wide angle view or high resolution) it affects the space time integration of the fluxes measured, either directly or as calculated. In this last case, necessary knowledge of the reflection pattern depends, in addition, on the angular sampling of the radiation. A series of questions is considered for which the answers are a prequisite to the organization of a global observation system. Author (ESA)

N80-27747# Institute of Oceanographic Sciences, Wormley (England).
SPACE AND TIME SCALES OF OCEAN CIRCULATION c48

W. J. Gould *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 105-110 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

The developments which have led to the present view of mesoscale features in the deep ocean are described. Results illustrating the space and time scales of features studied during the mid-ocean dynamics experiment are presented. Suggestions are made for fields in which satellite data are likely to enhance knowledge of ocean circulation. Author (ESA)

N80-27748# Institute of Oceanographic Sciences, Wormley (England).
SATELLITE ALTIMETRY MEASUREMENTS OF THE SEA SURFACE c43

T. D. Allan *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 113-120 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

Some of the preliminary observations made with the SEASAT precise radar altimeter are reviewed. Examples are taken from recently published work on data from over the western North Atlantic where the dynamic height profiles, calculated from the available geoid model, exhibit not only a strong one to two M signal over the width of the Gulf Stream, but also smaller amplitude anomalies which are associated with mobile cold rings of some 200 km diameter. Examples of repeat profiles recorded during the period of the SEASAT frozen orbit are shown over an area in the eastern Atlantic. They exhibit a remarkable repeatability of small features in the geoid and analysis to detect possible eddies and currents is discussed. A comparison of significant wave heights measured by the altimeter and by a surface buoy is shown to agree to about 20 cm. Author (ESA)

N80-27749# Appleton Lab., Slough (England).
SATELLITE MEASUREMENTS OF ATMOSPHERIC TEMPERATURE c48

J. T. Houghton *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 123-127 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

The remote sounding of atmospheric temperature is discussed. Application of this data to the study of variations in atmospheric density is mentioned. A formula to interpret emitted radiation observations at a given spectral frequency in terms of the distribution of temperature throughout the atmosphere is given. The accuracy with which temperature can be measured is evaluated relative to TIROS-N, NOAA 5, and NIMBUS satellite data. Results are compared to data collected by a worldwide radiosonde balloon network. Indications are that good meteorological analyses can be obtained from satellite data alone, also with better coverage of ocean areas. Author (ESA)

N80-27750# Freie Univ., Berlin (West Germany).
THE INTERANNUAL VARIABILITY OF THE STRATOSPHERE c48

K. Labitzke *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 129-133 (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

Midwinter warmings, circulation anomalies in the stratosphere, are discussed. As an example of the synoptic evolution of such a warming, radiances obtained by Nimbus 6 are given and analyzed. Results confirm that these warmings are forced by the planetary waves of the troposphere. The variability of the planetary waves and of their vertical structure is reflected by the large interannual variability of the stratosphere during the northern winters. It is suggested to monitor this interannual variability, which has not yet been explained, and to measure the vertical temperature distribution of the stratosphere, preferably with the same instrument, continuously over several years. Author (ESA)

N80-27751# National Physical Lab., Teddington (England).
COMPOSITION OF THE MIDDLE ATMOSPHERE: STATUS AND PRIORITIES c48

J. E. Harries *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 135-142 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

A brief review of the current status of knowledge of middle atmosphere composition is given. The importance of coupling between photochemistry, dynamics, and radiation is stressed. A list of outstanding scientific problems is given, and some priorities for future research using satellites are established. Author (ESA)

N80-27752# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
OZONE MONITORING FROM SPACE c48

A. Ghazi *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 143-151 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

Different methods of ozone observation by satellite are reviewed. A summary of the analyzed satellite ozone data is given. The importance of atmospheric ozone in influencing climate is emphasized based on the theoretical and observational knowledge obtained to date. Future needs of measurements and research priorities are briefly outlined. Author (ESA)

N80-27753# Technische Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
WATER VAPOR IN THE UPPER TROPOSPHERE AND IN THE STRATOSPHERE c48

H. Fischer *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 153-159 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

Knowledge of the global water vapor distribution and its seasonal changes in the upper troposphere and stratosphere is reviewed. The circulation of water vapor and the exchange processes between troposphere and stratosphere are emphasized in terms of contributions from satellite observation. In contrast to known mean water vapor distributions in the upper troposphere, only single measurements of the mixing ratio have been published for the stratosphere so that the theory about the stratospheric water vapor cycle cannot yet be confirmed. Although expected results of two limb sounding experiments aboard Nimbus 7 will yield new information, recommendations for future improved satellite systems are offered. Author (ESA)

N80-27754# Zentralanstalt fuer Meteorologie und Geodynamik, Vienna (Austria).
MOUNTAIN OVERFLOW PHENOMENA IN SATELLITE IMAGERY **c47**
V. Zwatz-Meise *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 163-168 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

Several orographically induced cloud configurations are investigated with the help of satellite images, while the necessary meteorological and geographical conditions for their formation are discussed. Possible applications of the results in meteorological research are shown, while the difficulties, such as low image resolution, the lack of appropriate ground truth measurements, and a low image frequency to show the whole formation process, are mentioned. Author (ESA)

N80-27755# Centre National de la Recherche Scientifique, Paris (France). Lab. de Meteorologie Dynamique.
METEOROLOGICAL RESEARCH AND CLOUD PARAMETER DERIVATION FROM SATELLITE DATA **c47**
M. Desbois and G. Szejwach *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 169-172 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

The current problems occurring in meteorological research from satellites, with emphasis on cloud parameter determination and imagery capabilities for synoptic and mesoscale studies, are reviewed. It is shown that much research is still needed given the data provided by the existing instrumentation. To effect some required improvements in the quality of information actually derived from satellite data, better accuracy and better time space resolution of the measurements are necessary. Author(ESA)

N80-27756# Servizio Meteorologico dell'Aeronautica Militaire (Italy).
METHODS AND PROBLEMS IN SATELLITE TEMPERATURE PROFILES AND WINDS **c47**
B. Bizzari *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 173-182 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

Analysis methods to determine vertical temperature profiles as well as wind parameters from satellite data are reviewed. Emphasis is on instrumentation shortcomings as revealed by theoretical considerations. Problems are ranked according to their limiting effect on analysis accuracy. Some methods containing loose assumptions relating to calculations are identified as being readily corrected by a more careful use of data. Other difficulties of a technical nature, such as cloud interference with readings, vertical resolution in sounding, or height attribution in winds, are seen as necessitating further developments in measurement technology. Author (ESA)

N80-27757# Centre National d'Etudes Spatiales, Paris (France). Paris Univ. (France).
A VIEW ON OUTSTANDING EXPERIMENTAL PROBLEMS IN SPACE OBSERVATION FOR METEOROLOGY AND CLIMATOLOGY **c47**
P. Morel *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 185-188 Prepared jointly with Paris Univ. (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

The application of meteorological satellite observation resources to climatology and related problems is discussed. Data needs include measurements on the radiation balance, the radiation effects of extended cloudiness, heat and moisture transport determinations, sea surface measurements, and ice processes observations. Emphasis is on possible European contributions to gathering this data. Author (ESA)

N80-27758*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A MICROWAVE PRESSURE SOUNDER FOR THE REMOTE MEASUREMENT OF ATMOSPHERIC SURFACE PRESSURE **c47**
D. A. Flower and G. E. Peckham *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 189-192 refs Sponsored jointly with UK Science Research Council Prepared jointly with Heriot-Watt Univ., Edinburgh (For primary document see N80-27733 18-42)
(Contract NAS7-100)
Avail: NTIS HC A10/MF A01 CSCL 04B

An instrument to measure atmospheric pressure at the Earth's surface from an orbiting satellite is considered. Surface pressure can be deduced from measurements of the transmission of an atmospheric column at several frequencies at the edges of the 60 GHz oxygen absorption band. An active microwave instrument proposed to make these measurements is the subject of a joint UK-US development program to demonstrate its capabilities. The results of an extensive analysis of the potential performance of the instrument are summarized. Author (ESA)

N80-27759# University Coll., London (England). Dept. of Physics and Astronomy.
GLOBAL WIND DETERMINATION BY INTERFEROMETRIC TECHNIQUES IN THE TROPOSPHERE, STRATOSPHERE AND MESOSPHERE **c47**
D. Rees *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 193-206 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

Remote sensing of atmospheric winds from the middle troposphere to the thermosphere on a global basis by means of a single instrument mounted on a low altitude, polar orbiting spacecraft is discussed. Factors of the instrument design, such as aperture and thermal stability, and of the spacecraft performance, particularly attitude control and measurement, are shown to be the major constraints affecting the accuracy of wind profile reconstruction and the obtainable spatial resolution. Given the practical possibilities offered by prospective missions, such as the NASA Upper Atmosphere Research Satellite (UARS) Program and the ESA/NASA shuttle/Spacelab missions, a target accuracy of 3 m/sec combined with a horizontal resolution of 100 to 200 km can be achieved with an altitude resolution of 3 km (up to 20 km) or 5 km (up to 70 km). The rapidity with which global wind data can be reconstructed and made available for meteorological purposes is mainly dependent on the stability and absolute accuracy of the spacecraft attitude control system. Author (ESA)

N80-27760# Cambridge Univ. (England). Dept. of Applied Mathematical and Theoretical Physics.
OCEAN CIRCULATION **c48**
D. L. T. Anderson *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 209-215 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

Several different phenomena are discussed which have quite a large signature in sea surface elevation. Satellite altimetry is shown to have the potential for monitoring these phenomena and increasing knowledge of them. To date, only eddies have been mapped successfully by altimeters. Nonetheless, attempts should be made to try to measure other variables both at and below the ocean surface. Author (ESA)

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-27761 Kansas Univ., Lawrence.
THE EVALUATION OF A METHODOLOGY TO MEASURE MANUAL DIGITIZING ERROR IN CARTOGRAPHIC DATA BASES Ph.D. Thesis
Charles Tim Traylor 1979 122 p
Avail: Univ. Microfilms Order No. 8014441

Four hypotheses were tested: (1) that digitizing error is a nonrandom phenomenon; (2) that individual subjects make systematic errors that are related to the direction of motion of

the hands and arms; (3) that similar directional errors occur across the entire subject population; and (4) that individual digitizing performance can be improved through a program of training using specially designed feedback. The procedure involved the arithmetic comparison of two digital files, one representing the X-Y coordinates of a test shape, and the other representing sample responses from subjects digitizing the shape. Fifteen subjects were tested to establish the general patterns of error, and one subject was tested to establish that this new information might be used in a training program to reduce the errors. The results indicated that direction of motion was a contributing factor to the overall error pattern of a digitizer operator, and that the error pattern can be modeled. Also, the digitizing error was found to be a nonrandom phenomenon. The training program indicated that knowledge of the error pattern could lead to decreased error. Dissert. Abstr.

N80-27762 Cornell Univ., Ithaca, N. Y.
THE BOUNDARY INTEGRAL EQUATION METHOD APPLIED TO FREE SURFACE FLOW PROBLEMS IN POROUS MEDIA Ph.D. Thesis
Gerard Patrick Lennon 1980 179 p
Avail: Univ. Microfilms Order No. 8015700

The boundary integral equation method (BIEM) is an efficient numerical method which can be employed to solve a wide variety of applied engineering problems because all computations are performed on the boundary of the region of interest rather than throughout the solution domain. The method is restricted to rather simple partial differential equations with a known Green's function. For transient problems, the BIEM can be used in conjuction with a time-stepping procedure to obtain solutions without iteration. For steady-state problems, part of the boundary data are applied on the steady-state free surface; however, because the location of the free surface is part of the problem, the problem cannot be solved unless the location of the free surface is know. The BIEM uses an efficient iteration scheme to locate the steady-state surface. Problems considered include the rise of water table resulting from the application of fluid recharge, steady-state axisymmetric flow towards a fully penetrating pumping well in an unconfined aquifer, and the steady-state flow from a pond towards a water table. Dissert. Abstr.

N80-27763 California Univ., Berkeley.
STATISTICAL INVESTIGATION OF THE PROPAGATION OF RANDOM AND NON-RANDOM ERRORS IN BLOCK AEROTRIANGULATION SYSTEMS Ph.D. Thesis
Clement Changyun Lee 1979 323 p
Avail: Univ. Microfilms Order No. 8014773

Three block aerotriangulation techniques including bundle adjustment, independent models, and polynomials were utilized. The computer programs for simulating various types of data blocks and for fully analytical block adjustments containing error propagation capability were developed and used with simulated data blocks. Results indicate that simulated photogrammetric data provide a very effective method for studying individual and compound error propagation in analytical aerotriangulation systems. The study shows that the propagated errors of exterior orientation parameters are not suitable for distinguishing random or nonrandom errors. On the basis of statistical tests, the bundle method provides more accurate results than adjustment with independent models or by polynomials. On the other hand, the bundle adjustment with addition parameters indicates that this procedure is a very effective technique for compensation of uncorrected nonrandom errors. However, the image coordinates refinement technique is still very useful, and should be applied. Dissert. Abstr.

N80-27764*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
LABEL IDENTIFICATION FROM STATISTICAL TABULATION (LIST)
T. B. Dennis, Principal Investigator Mar. 1980 18 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10132; NASA-CR-160584; SR-LO-00430; LEMSCO-14390; JSC-16345) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-27765*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
ON THE ACCURACY OF PIXEL RELAXATION LABELING
D. A. Landgrebe, Principal Investigator, J. A. Richards, and P. H. Swain Mar. 1980 34 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10185; NASA-CR-160691; SR-P0-00455; LARS-TR-030180) Avail: NTIS HC A03/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-27766*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
DATA RESOLUTION VERSUS FORESTRY CLASSIFICATION
Edwin P. F. Kan and David L. Ball, Principal Investigators Dec. 1974 34 p refs Sponsored in part by USDA ERTS
(Contract NAS9-12200)
(E80-10189; NASA-CR-160610) Avail: NTIS HC A03/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-27767*# Environmental Research Inst. of Michigan, Ann Arbor.
ANALYSIS OF SCANNER DATA FOR CROP INVENTORIES Quarterly Progress Report, 16 Feb. - 15 May 1980
Robert Horvath, R. Cicone, E. Crist, R. Kauth, and W. Pont, Principal Investigators May 1980 142 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15476; Proj. AgRISTARS)
(E80-10191; NASA-CR-160692; ERIM-132400-40-P) Avail: NTIS HC A07/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-27768*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
AS-BUILT SPECIFICATION FOR THE ERIM TAPE CONVERSION TO LARSYS 2 PROGRAM (ECTL2)
L. F. Robinson, Principal Investigator Dec. 1976 25 p ERTS
(Contract NAS9-12200)
(E80-10202; NASA-CR-160614; LEC-9857; JSC-11833) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-27769*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
FINAL DESIGN SPECIFICATION FOR LARSYS/ISOCLS MODIFICATION FOR LACIE PHASE 3
B. F. Wills, Principal Investigator Feb. 1977 70 p ERTS
(Contract NAS9-12200)
(E80-10212; NASA-CR-160612; LEC-10161; JSC-12542) Avail: NTIS HC A04/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-27770*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
TRANSFER OF INTERACTIVE REPORT EXTRACTED DATA (TIRED) REQUIREMENTS SPECIFICATION
Kenneth L. Pattison, Principal Investigator Jun. 1976 10 p ERTS
(Contract NAS9-12200)
(E80-10219; NASA-CR-160615; LEC-8841; JSC-11365) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-27771*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.

TRANSFER OF INTERACTIVE REPORT EXTRACTED DATA (TIRED) REQUIREMENTS SPECIFICATION

Kenneth L. Pattison, Principal Investigator Jun. 1976 10 p ERTS

(Contract NAS9-12200)

(E80-10221; NASA-CR-160611; LEC-8841-Rev-A; JSC-11365-Rev-A) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-27772*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.

PDP 11/45 LACIE PHASE 11/111 AUTOMATIC STATUS AND TRACKING SYSTEM FUNCTIONAL DESIGN SPECIFICATION

J. M. Evanette and D. L. Smith, Principal Investigators Nov. 1976 53 p ERTS

(Contract NAS9-12200)

(E80-10222; NASA-CR-160613; LEC-9861; JSC-11835) Avail: NTIS HC A04/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-27773*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

A NOTE ON THE GENERATION OF POISSON-DISTRIBUTED RANDOM NUMBERS WITH LARGE MEAN

George R. Terrell, Principal Investigator Apr. 1980 11 p refs ERTS

(Contract NAS9-15800)

(E80-10224; NASA-CR-160656) Avail: NTIS HC A02/MF A01 CSCL 12A

There are no author-identified significant results in this report.

N80-27774*# Lockheed Electronics Co., Houston, Tex.

SCREWWORM ERADICATION DATA SYSTEM, PHASE 2 PROJECT PLAN: FIELD TESTS

Aug. 1975 15 p ERTS

(Contract NAS9-12200)

(E80-10225; NASA-CR-160616; LEC-6473; JSC-09825) Avail: NTIS HC A02/MF A01 CSCL 08C

There are no author-identified significant results in this report.

N80-27775*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

EARTH OBSERVATIONS DIVISION VERSION OF THE LABORATORY FOR APPLICATIONS OF REMOTE SENSING SYSTEM (EOD-LARSYS) USER GUIDE FOR THE IBM 370/148. VOLUME 3: AS-BUILT DOCUMENTATION (SECTIONS 1-12)

M. L. Burnell and P. J. Aucoin, Principal Investigators Apr. 1980 349 p ERTS

(Contract NAS9-15800)

(E80-10226; NASA-CR-160658; LEMSCO-12565-Rev-A; JSC-13821-Rev-A) Avail: NTIS HC A15/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-27776*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

EARTH OBSERVATIONS DIVISION VERSION OF THE LABORATORY FOR APPLICATIONS OF REMOTE SENSING SYSTEM (EOD-LARSYS) USER GUIDE FOR THE IBM 370/148. VOLUME 3: AS-BUILT DOCUMENTATION (SECTIONS 13-23)

M. L. Burnell and P. J. Aucoin, Principal Investigators Apr. 1980 442 p ERTS

(Contract NAS9-15800)

(E80-10227; NASA-CR-160659; LEMSCO-12565-Rev-A; JSC-13821-Rev-A) Avail: NTIS HC A19/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-27777*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A COMPARISON OF RADIATIVE TRANSFER MODELS FOR PREDICTING THE MICROWAVE EMISSION FROM SOILS

T. J. Schmugge (Computer Sciences Corp., Silver Spring, Md.) and B. J. Choudhury May 1980 32 p refs Submitted for publication

(NASA-TM-80688; G-F4504) Avail: NTIS HC A03/MF A01 CSCL 08M

Two general types of numerical models for predicting microwave emission from soils are compared-coherent and noncoherent. In the former, radiation in the soil is treated coherently, and the boundary conditions on the electric fields across the layer boundaries are used to calculate the radiation intensity. In the latter, the radiation is assumed to be noncoherent, and the intensities of the radiation are considered directly. The results of the two approaches may be different because of the effects of interference, which can cause the transmitted intensity at the surface (i.e., emissivity) to be sometimes higher and sometimes lower for the coherent case than for the noncoherent case, depending on the relative phases of reflected fields from the lower layers. This coupling between soil layers in the coherent models leads to greater soil moisture sampling depths observed with this type of model, and is the major difference that is found between the two types of models. In noncoherent models, the emissivity is determined by the dielectric constraint at the air/soil interface. The subsequent differences in the results are functions of both the frequency of the radiation being considered and the steepness of the moisture gradient near the surface. The calculations were performed at frequencies of 1.4 and 19.4 GHz and for two sets of soil profiles. Little difference was observed between the models at 19.4 GHz; and only at the lower frequency were differences apparent because of the greater soil moisture sampling depth at this frequency. Author

N80-27778*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MAGSAT SCIENTIFIC INVESTIGATIONS

Robert A. Langel May 1980 42 p refs Submitted for publication

(NASA-TM-80698) Avail: NTIS HC A03/MF A01 CSCL 08G

The Magsat spacecraft is providing the first global, vector magnetic survey. Investigations using the Magsat data are being carried out by scientists at NASA's Goddard Space Flight Center, at the U.S. Geological Survey of the Department of the Interior and by 32 selected investigators. Nineteen of the investigators are from the United States and 13 are from various foreign nations. The investigations described fall into four categories: (1) geomagnetic field modeling; (2) crustal magnetic anomaly studies; (3) investigations of the inner Earth: the core, mantle and core-mantle interface; and (4) studies of external current systems. Author

N80-27779*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SNOWPACK MONITORING IN NORTH AMERICA AND EURASIA USING PASSIVE MICROWAVE SATELLITE DATA

J. L. Foster, A. Rango, and D. K. Hall [1980] 23 p refs Submitted for publication

(NASA-TM-80706) Avail: NTIS HC A02/MF A01 CSCL 08L

Areas of the Canadian high plains, the Montana and North Dakota high plains, and the steppes of central Russia were studied in an effort to determine the utility of spaceborne electrical scanning microwave radiometers (ESMR) for monitoring snow depths in different geographic areas. Significant regression relationships between snow depth and microwave brightness temperatures were developed for each of these homogeneous areas. In the areas investigated, Nimbus 6 (.081 cm) ESMR data produced higher correlations than Nimbus 5 (1.55 cm) ESMR data in relating microwave brightness temperature and snow depth from one area to another because different geographic areas are likely to have different snowpack conditions. L.F.M.

N80-27780*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

REMOTE SENSING OF SOIL MOISTURE CONTENT OVER BARE FIELDS AT 1.4 GHz FREQUENCY

J. R. Wang and B. J. Choudhury (Computer Sciences Corp., Silver Spring, Md.) Jun. 1980 26 p refs Submitted for publication

(NASA-TM-80711) Avail: NTIS HC A03/MF A01 CSCL 08M

A simple method of estimating moisture content (W) of a bare soil from the observed brightness temperature (T sub B) at 1.4 GHz is discussed. The method is based on a radiative transfer model calculation, which has been successfully used in the past to account for many observational results, with some modifications to take into account the effect of surface roughness. Besides the measured T sub B's, the three additional inputs required by the method are the effective soil thermodynamic temperature, the precise relation between W and the smooth field brightness temperature T sub B and a parameter specifying the surface roughness characteristics. The soil effective temperature can be readily measured and the procedures of estimating surface roughness parameter and obtaining the relation between W and smooth field brightness temperature are discussed in detail. Dual polarized radiometric measurements at an off-nadir incident angle are sufficient to estimate both surface roughness parameter and W, provided that the relation between W and smooth field brightness temperature at the same angle is known. The method of W estimate is demonstrated with two sets of experimental data, one from a controlled field experiment by a mobile tower and the other, from aircraft overflight. The results from both data sets are encouraging when the estimated W's are compared with the acquired ground truth of W's in the top 2 cm layer. An offset between the estimated and the measured W's exists in the results of the analyses, but that can be accounted for by the presently poor knowledge of the relationship between W and smooth field brightness temperature for various types of soils. An approach to quantify this relationship for different soils and thus improve the method of W estimate is suggested.

L.F.M.

N80-27781*# National Aeronautics and Space Administration, Washington, D. C.

THE HIGH VISIBLE RESOLUTION (HVR) INSTRUMENT OF THE SPOT GROUND OBSERVATION SATELLITE

G. Otrio Apr. 1980 22 p Transl. into ENGLISH of conf. paper "L'Instrument a Haute Resolution Visible (HRV) du Satellite d'Observation de la Terre: Spot", Rept. IAF-79-F-239 Intern. Astronautical Federation, Munich, Sep. 1979 p 1-13 Presented at 30th Intern. Astronautical Federation, Munich, Sep. 1979 Original language document was announced as A79-53369 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Natl. Space Studies Center, Toulouse

(Contract NASw-3199)

(NASA-TM-75830: IAF-79-F-239) Avail: NTIS HC A02/MF A01 CSCL 20F

Two identical high resolution cameras, capable of attaining a track width of 116 km in an almost vertical line of sight from the two 60 km images of each instrument, will be carried on the initial mission of the space observation of Earth satellite (SPOT). Specifications for the instrument, including the telescope and CCD devices are summarized. The present status of development is described including the optical characteristics, structure and thermal control, detector assembly, elctronic equipment, and calibration. SPOT mission objectives include the developments relating to soil use, the exploration of EART Earth resources, the discrimination of plant species, and cartography.

A.R.H.

N80-27782*# National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.

AIRBORNE LASER TOPOGRAPHIC MAPPING RESULTS FROM INITIAL JOINT NASA/US ARMY CORPS OF ENGINEERS EXPERIMENT

W. B. Krabill, J. G. Collins (Army Corps of Engineers, Vicksburg, Miss.), R. N. Swift (EG and G Washington Analytical Services Center, Inc., Pocomoke City, Md.), and M. L. Butler (EG and G Washington Analytical Services Center, Inc., Pocomoke City, Md.) Jun. 1980 36 p

(NASA-TM-73287) Avail: NTIS HC A03/MF A01 CSCL 08B

Initial results from a series of joint NASA/US Army Corps of Engineers experiments are presented. The NASA Airborne Oceanographic Lidar (AOL) was exercised over various terrain conditions, collecting both profile and scan data from which river basin cross sections are extracted. Comparisons of the laser data with both photogrammetry and ground surveys are made, with 12 to 27 cm agreement observed over open ground. Foliage penetration tests, utilizing the unique time-waveform sampling capability of the AOL, indicate 50 cm agreement with photogrammetry (known to have difficulty in foliage covered terrain).

Author

N80-27783# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Geopositional Dept.

ANALYTICAL PLOTTERS IN DEFENSE MAPPING AGENCY

David H. Alspaugh Apr. 1980 13 p refs

(AD-A083794) Avail: NTIS HC A02/MF A01 CSCL 08/2

Computer assisted stereoplotters and comparators have been in development and in use by DMA for many years. Use of this type of equipment has reached a reasonable state of maturity in the support of the DMA production programs. Application of this type of equipment in DMA exemplify its potential to aerial triangulation and compilation of relief and planimetry. Several of these applications are reviewed so as to emphasize the range of tasks that can be performed on computer assisted equipment given the proper software engineering.

GRA

N80-27784# Ohio Agricultural Research and Development Center, Wooster.

RESEARCH ON THE HYDROLOGY AND WATER QUALITY OF WATERSHEDS SUBJECTED TO SURFACE MINING. PHASE 1: PREMINING HYDROLOGIC AND WATER QUALITY CONDITIONS Summary Report, 22 Jan. 1976 - 22 Jan. 1978

Gary E. McIntosh and W. R. Harmon 22 Dec. 1979 35 p Prepared in cooperation with Science and Education Administration, Coshocton, Ohio

(Contracts DI-BM-J0-166054; DI-BM-J0-166055)

(PB80-159510: BM-OFR-31-80) Avail: NTIS HC A03/MF A01 CSCL 08H

Five watersheds, ranging in size from 29 to 52 acres, were selected in east-central Ohio for the purpose of investigating the hydrologic and water quality conditions occuring before, during, and after surface mining. The average concentrations of the water quality parameters for all watersheds were as low or lower than the Environmental Protection Agency recommended maximum allowable concentrations in drinking water except for suspended solids. Before mining the average concentration of suspended solids in storm runoff ranged from 118 to 1,100 micrograms/1, and for base flow the range was from 44 to 247 micrograms/1; the higher concentrations were associated with the watersheds exhibiting the greatest premining disturbance. Iron ranged from an average of less than 3 to 228 micrograms/1. Manganese ranged from less than 41 to 334 micrograms/1. Premining ground water systems for each watershed had two major perched aquifers within the top 205 ft.

GRA

N80-27785# Bendix Field Engineering Corp., Grand Junction, Colo.

DEVELOPMENT OF DATA ENHANCEMENT AND DISPLAY TECHNIQUES FOR STREAM-SEDIMENT DATA COLLECTED IN THE NATIONAL URANIUM RESOURCE EVALUATION PROGRAM OF THE UNITED STATES DEPARTMENT OF ENERGY

G. S. Koch, Jr. (Georgia Univ., Athens), R. J. Howarth (Imperial Coll., London), R. H. Carpenter (Georgia Univ., Athens), and J. H. Schvenemeyer (Delaware Univ.) Athens, Ga. Georgia Univ. Aug. 1979 236 p refs

(Contract EY-76-C-13-1664)

(GJBX-28(80)) Avail: NTIS HC A11/MF A01

Statistical, mapping, and geological techniques were combined in order to evaluate and appropriately display geochemical data for the identification of uranium associated halos utilizing the NURE hydrogeochemical and stream sediment reconnaissance data base. A set of computer-based procedures implemented in a time-sharing interactive mode on a Control Data Corporation Cyber 70 and 174 computer was developed. Techniques of data analysis are developed. Results of the data analysis for the

Southeastern area, Seguin quadrangle, and Pueblo quadrangle are presented. Conclusions are drawn and recommendations are stated. DOE

N80-27786# Massachusetts Univ., Amherst. Water Resources Research Center.
THE DEVELOPMENT OF PALIS: A PONDS AND LAKES INFORMATION SYSTEM FOR MASSACHUSETTS
Paul J. Godfrey, Spencer A. Joyner, Jr., Edward L. Goldstein, and Linda Ross Dec. 1979 254 p
(Contract DI-14-34-0001-9023)
(PB80-156979; Pub-108; WB0-03902; OWRT-A-124-MASS(1)) Avail: NTIS HC A12/MF A01 CSCL 08H

A state-of-the-art information system for managing ponds and lakes resources at the state level was accomplished for Massachusetts by (1) assessing the quality and quantity of existing ponds and lakes information, (2) surveying the state of the art of computerized management information systems including water resources information systems, (3) evaluating the implications for state agencies of computerizing in a single system all the ponds and lakes information they already possess and (4) designing a management information system for Massachusetts ponds and lakes information. This design included the creation of a complex data base structure which was suited to existing computer software packages, and the development of a functioning pilot demonstration system based on state agency for 20 lakes and ponds. GRA

N80-27787# Texas Dept. of Water Resources, Austin.
GROUND-WATER RESOURCES AND MODEL APPLICATIONS FOR THE EDWARDS (BALCONES FAULT ZONE) AQUIFER IN THE SAN ANTONIO REGION, TEXAS
Glenward R. Elder, William B. Klemt, Tommy R. Knowles, and Thomas W. Sieh Oct. 1979 96 p refs
(PB80-157332; TDWR/R-239) Avail: NTIS HC A05/MF A01 CSCL 08H

The occurrence, availability, and dependability of the Edwards Aquifer in the Nueces, San Antonio, Guadalupe-Blanco River basins was determined in order to develop a ground water resources management tool for use in a total water-resource management program for the three river basins. The quantitative aspects of ground-water withdrawals, spring flows, and aquifer characteristics were of particular interest. Test wells were drilled: (1) to describe the lithology of the stratigraphic units which make up the Edwards (Balcones Fault Zone) aquifer; (2) to determine the upper and lower hydrologic boundaries; (3) to determine the average total porosity for various aquifer levels; and (4) to determine the average effective porosity (specific yield) and the approximate artesian storage values for the aquifer through core analysis. GRA

N80-27788# Arizona Univ., Tucson. Dept. of Geosciences.
GEOPHYSICAL AND HYDROLOGIC PREDICTION OF FISSURING AND LAND SUBSIDENCE, SOUTH-CENTRAL ARIZONA
J. S. Sumner and F. J. Christie Mar. 1980 9 p refs
(Contracts DI-14-34-0001-7005; DI-14-34-0001-7006)
(PB80-159906; WB0-04013; OWRT-A-073-ARIZ(3)) Avail: NTIS HC A02/MF A01 CSCL 08G

The gravity exploration method was employed to survey the Picacho basin area in south-central Arizona where numerous fissures are located and where the land has subsided in excess of 12.5 feet (3.96 m) since 1952. A differential subsidence concept would predict that vertical offset fissures would most likely occur over basement irregularities. Therefore, the gravity data were interpreted in terms of the probable variation in thickness of alluvium overlying the more dense bedrock. Modeling of the bedrock surface under the basin area reveals a strong correlation between gravity gradients and earth fissures. It can be concluded that most vertical offset earth fissures are related bedrock irregularities, and that the gravity method holds promise in predicting the probable occurrence of these features. GRA

N80-27789# Woodard-Clyde Consultants, San Francisco, Calif.
DEWATERING SYSTEMS FOR SURFACE COAL MINES Final Report, Sep. 1977 - Dec. 1979
J. E. ORourke and K. OConnor 21 Dec. 1979 260 p refs
(Contract DI-BM-J0-275025)
(PB80-160153; BM-OFR-32-80) Avail: NTIS HC A12/MF A01 CSCL 08I

Available dewatering technology is assessed and its relevance to surface coal mines in the interior province of the United States is evaluated. Guidelines for the selection, design, and construction of dewatering systems are included. On the basis of documented experience, candidate dewatering systems were selected and evaluated with respect to their anticipated impact on the environment and mine operations. Laws and regulations that can impact on dewatering operations are summarized. Geologic and hydrogeologic conditions within the interior province are described and potential dewatering problems at surface coal mines are identified. Model mines are developed that exhibit the most difficult dewatering problems identified, and it is demonstrated how available technology can be utilized to deal with them. GRA

N80-27790# Texas A&M Univ., College Station. Coll. of Geosciences.
SONAR PROBING AS A MINING AND TUNNELING TOOL Progress Report, 21 Dec. 1978 - 30 Sep. 1979
Robert R. Unterberger 30 Sep. 1979 95 p refs
(Grant NSF APR-76-21764)
(PB80-159239; NSF/RA-790255) Avail: NTIS HC A05/MF A01 CSCL 08I

To avoid multiple signals which are difficult to interpret, a narrow beam is produced in rock salt to determine the azimuth and elevation of the various targets seen in time. A high frequency transducer is driven to two frequencies that causes the salt itself to go nonlinear and generate the difference frequency which is comparable to that of the high frequency beam. It is believed that this breakthrough could drastically improve the ability of the sonar probing system to discriminate reflected signals in salt in azimuth and elevation. Unsuccessful experiments on attenuation measurements of sound in salt are described, as well as successful tests, to improve the signal to noise ratio of the signals reflected from discontinuities in the salt. Measurements on the amount of noise in salt as a function of frequency are briefly discussed. GRA

N80-27791# Great Lakes Basin Commission, Ann Arbor, Mich.
FUTURE US PHOSPHORUS LOADINGS TO THE GREAT LAKES: AN INTEGRATION OF WATER QUALITY MANAGEMENT PLANNING INFORMATION Final Report
Thomas M. Heidtke, Timothy J. Monteith, Rose Ann Sullivan, Douglas J. Scheflow, and William E. Skimin Oct. 1979 75 p refs Sponsored in part by Water Resources Council
(PB80-160336; GLBC/GLEPS-11) Avail: NTIS HC A04/MF A01 CSCL 08H

Information derived from individual water quality management plans was aggregated to generate projections of U.S. total phosphorus loads to the Great Lakes. Computer simulation techniques were then used to evaluate and compare the cost-effectiveness of alternatives for controlling phosphorus inputs from municipal point sources and land drainage. The results reveal that reduction of municipal wastewater effluent concentrations to meet a 1 mg/l total phosphorus limitation represents the most critical step in controlling future loadings, in terms of both cost-effectiveness and net reduction in annual input to the Great Lakes. Implementation of this control measure will result in almost a 60 percent reduction in the U.S. municipal input between the mid 1970's and the year 1990. Although population growth will result in a gradual increase in the load between the years 1990 and 2000, the municipal input will remain well below mid-1970 levels. GRA

N80-27792# Water Resources Council, Washington, D.C.
OPTIONS TO IMPROVE FEDERAL NONSTRUCTURAL RESPONSE TO FLOODS
Rutherford H. Platt (Massachusetts Univ., Amherst) 1 Dec. 1979 141 p refs Sponsored in part by President's Committee on Water Policy
(PB80-160146) Avail: NTIS HC A07/MF A01 CSCL 08H

Federal response to floods at present is fragmented by agency, by objective, by authority, and by mode of cost sharing. Various programs rehabilitate private victims through grants, loans, and tax subsidies. Other programs address community restoration

through the restoration of structures, debris clearance, repair of flood controls, and emergency livestock feeding. Methods for reducing the sucsestibilities of properties and lives to future losses are discussed with emphasis on cooperation with local governments and agencies. Topics covered include flood plain regulation, land acquisition, flood proofing, and flood insurance. A.R.H.

N80-27793# Water Resources Council, Washington, D.C.
IMPROVED FORMULATION AND EVALUATION OF NONSTRUCTURAL ELEMENTS FOR WATER RESOURCES PLANS IN FLOOD HAZARD AREAS
Leonard A. Shabman (Virginia Polytechnic Inst. and State Univ., Blacksburg) Oct. 1979 34 p ref
(PB80-160120) Avail: NTIS HC A03/MF A01 CSCL 08H

Planning concepts and procedures are considered, especially multiple purpose planning. Three standards are suggested: (1) full and equal consideration of the multiple means of resource management for water and related land resources; (2) recognize that several available means for resource management can be developed to serve multiple purposes; and (3) evaluate the contributions of serving multiple purposes to multiple social objectives by application of conceptually sound evaluation methodologies. GRA

N80-27794# National Oceanic and Atmospheric Administration, Boulder, Colo. World Data Center A for Glaciology.
INVENTORY OF SNOW COVER AND SEA ICE DATA
R. G. Crane, comp. Dec. 1979 166 p
(PB80-164007; GD-7; NOAA-80022901) Avail: NTIS HC A08/MF A01 CSCL 08L

Snow cover and sea ice data were surveyed with emphasis on map series or data sets which characterize these two cryospheric parameters on a regional to global scale. Such information is of broad relevance to problems of global climate, hydrology, and environmental monitoring, as well as for operational and planning purposes in conjunction with engineering projects, transportation, agriculture, and energy assessments. The present inventory is primarily concerned with sets of large-scale snow cover data. A summary of data available from the State Snow Surveys and from a few of the regional-scale operational and experimental snow cover data sets is included. Some national data sets from non-U.S. sources are also described. The inventory of sea ice data sources focuses on mapped information relating to the seasonal cycle. GRA

N80-27795# NEUS, Inc., Santa Monica, Calif.
BIOSOURCES DIGEST, A JOURNAL ON BIOMASS UTILIZATION, VOLUME 1, NO. 2
Harry Sobel, ed. Apr. 1979 73 p refs
(Grant NSF PFR-77-12500)
(PB80-157662; NSF/RA-790175) Avail: NTIS HC A04/MF A01 CSCL 10A

The management and uses of marine resources are considered including current and potential developments in ocean farming which utilize the giant kelp (Macrocystis pyrifera). This rapidly growing species may be converted anaerobically into substitute natural gas and additionally produce enormous quantities of minerals, fertilizers, and livestock and human feed. It also enhances local fish crops. Preliminary cost estimates show this process of gas production to be competitive with alternate gas supply sources. Some of the technical and economic factors of ocean farming are discussed as well as methods for obtaining chemicals from a northern kelp. Books and papers received, grants awarded by NSF, DOE, and USDA, pertinent patents, NTIS publications, research announcements, and future meetings are listed. GRA

N80-27748# Institute of Oceanographic Sciences, Wormley (England).
SATELLITE ALTIMETRY MEASUREMENTS OF THE SEA SURFACE
T. D. Allan *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 113-120 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-28293# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE KLOPPENHEIM SATELLITE OBSERVATION STATION: DETERMINATION OF LONGITUDE, LATITUDE, AND ASTRONOMICAL AZIMUTH WITH THE PASSAGE INSTRUMENT Ap 70 [SATELLITENBEOBACHTUNGSSTATION KLOPPENHEIM BESTIMMUNG VON LAENGE, BREITE UND AZIMUTH MIT DEM PASSAGEINSTRUMENT Ap 70]
Hansdieter Grosse *In its* Activities of the Kloppenheim Satellite Obs. Station 1979 p 5-19 refs In GERMAN; ENGLISH summary (For primary document see N80-28292 18-99)
Avail: NTIS HC A04/MF A01

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-27796 State Univ. of New York at Buffalo.
CURRENT CONDUCTION MECHANISM AND DESIGN OPTIMIZATION STUDY OF MIS SOLAR CELLS Ph.D. Thesis
Kamal Rajkanan 1980 384 p
Avail: Univ. Microfilms Order No. 8016237

The current conduction mechanism studies are related to the design optimization problems in MIS solar cells. Specifically, a SiO-Cu-Cr-SiO2-(p)Si-Al structure on both single and polycrystalline silicon was used. The current conduction mechanisms in these MIS solar cells were determined by studying the dark and solar characteristics over a wide range of temperature. It was shown that the current can be either diffusion limited, tunnel limited or space charge limited, depending on the design and the surface conditions. Band to band tunneling and the tunneling via surface states were identified. Based on experimentally determined current conduction mechanisms, a simulation model was developed which considers the total design of the real world MIS solar cell. The simulated results are shown to agree with the experimental data on the actual devices. The simulation model was used to determine the loss mechanisms in these solar cells. The sensitivity of device performance with different design variables was determined, thus establishing overall design guidelines for fabricating high efficiency MIS solar cells. Dissert. Abstr.

N80-27797 California Univ., Berkeley.
CHEMICAL, STRUCTURAL AND OPTICAL CHARACTERIZATION OF A BLACK CHROME SOLAR SELECTIVE ABSORBER Ph.D. Thesis
Carl Matthew Lampert 1979 170 p
Avail: Univ. Microfilms Order No. 8014770

The very popular black chrome coating, Harshaw Chemical's 'Chromonyx' was analyzed in terms of materials science to determine the nature of its microstructure and the relationship to wavelength selectivity. This coating serves as an efficient solar thermal conversion coating for both concentrating and flat plate solar collectors. Principally, energy dispersive X-ray analysis as well as scanning and transmission electron microscopy were employed for thin film analysis. A wide range of experiments were performed to correlate both the as-plated and annealed microstructure to reflectance measurements. Along with supplemental information on Auger and XPS depth profiling from other investigators, it was possible to develop a physical metallurgical model for the wavelength selectivity properties of this coating. Microstructural analysis was performed on 1 - 100 hour annealed specimens over the temperature range of 300-600 C, in atmospheres of air and medium vacuum. Black chrome solar selectivity degrades by the nucleation and growth of Cr203 particles. These particles alter the absorptive properties of the coating by depleting and redistributing metallic chromium. The coating also emanates CO and CO2 which may break up the coating, enhancing oxidation. At high temperatures above

500 C this coating appears densified and totally oxidized. It is suggested that this black chrome degrades by a simple diffusion controlled oxidation mechanism. Dissert. Abstr.

N80-27798 California Univ., Berkeley.
PHOTOVOLTAIC PROPERTIES OF METAL-MEROCYANINE-TiO2 SANDWICH CELLS Ph.D. Thesis
Terje Asbjorn Skotheim 1979 147 p
Avail: Univ. Microfilms Order No. 8014882

Photocurrent generation in thin films of merocyanine photosensitizing dyes sandwiched between an n-type semiconductor and a metal overlayer was studied using photovoltaic techniques. In the system analyzed in detail TiO2 single crystal, doped n-type, was used as the semiconductor and a semitransperent Au film as a metal overlayer. A comprehensive theoretical model was developed to explain the observed photovoltaic properties. The model assumes that the principal route for the formation of charge carriers is via singlet excitons diffusing to the merocyanine TiO2 interface followed by dissociation of the excitons into electron-hole pairs, the electrons being injected into the TiO2 conduction band and the holes into the merocyanine. The model also incorporates field dependence of the quantum efficiency for charge generation and is strongly supported by a variety of steady state and kinetic measurements. An exciton diffusion length of 79 angstroms was determined by analyzing the short circuit action spectra using the theoretical model developed. Dissert. Abstr.

N80-27799*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENGINEERING TEST FACILITY DESIGN DEFINITION
R. W. Bercaw and G. R. Seikel 20 Jun. 1980 16 p refs
Presented at 7th Intern. Conf. on Magnetohydrodynamic Elect. Power Generation, Cambridge, Mass., 16-20 Jun. 1980; sponsored by Symp. on the Eng. Aspects of Magnetohydrodynamics, Inc.
(Contract EF-77-A-01-2674)
(NASA-TM-81499; DOE/NASA/2674-11; E-436) Avail: NTIS HC A02/MF A01 CSCL 10A

The Engineering Test Facility (ETF) is the major focus of the Department of Energy (DOE) Magnetohydrodynamics (MHD) Program to facilitie commercialization and to demonstrate the commercial operability of MHD/steam electric power. The ETF will be a fully integrated commercial prototype MHD power plant with a nominal output of 200 MW sub e. Performance of this plant is expected to meet or surpass existing utility standards for fuel, maintenance, and operating costs; plant availability; load following; safety; and durability. It is expected to meet all applicable environmental regulations. The current design concept conforming to the general definition, the basis for its selection, and the process which will be followed in further defining and updating the conceptual design. Author

N80-27800*# Lutz-Sotire Partnership, Stamford, Conn.
SOLAR HEATING SYSTEM INSTALLED AT STAMFORD, CONNECTICUT Final Report
Sep. 1979 83 p Sponsored in part by DOE
(Contract EX-76-C-01-2377)
(NASA-CR-161436) Avail: NTIS HC A05/MF A01 CSCL 10A

The solar heating system installed at the Lutz-Sotire Partnership Executive East Office Building, Stamford, Connecticut is described. The Executive East Office Building is of moderate size with 25,000 sq ft of heated space in 2 1/2 stories. The solar system was designed to provide approximately 50 percent of the heating requirements. The system components are described. Appended data includes: the system design acceptance test, the operation and maintenance manual, and as-built drawings and photographs. R.E.S.

N80-27801*# General Electric Co., Wilmington, Mass. Aircraft Equipment Div.
SOLID POLYMER ELECTROLYTE FUEL CELL TECHNOLOGY PROGRAM Final Report
31 May 1980 53 p refs
(Contract NAS9-15286)
(NASA-CR-160734; TPR-77) Avail: NTIS HC A04/MF A01 CSCL 10A

Work is reported on phase 5 of the Solid Polymer Electrolyte (SPE) Fuel Cell Technology Development program. The SPE fuel cell life and performance was established at temperatures, pressures, and current densities significantly higher than those previously demonstrated in sub-scale hardware. Operation of single-cell Buildup No. 1 to establish life capabilities of the full-scale hardware was continued. A multi-cell full-scale unit (Buildup No. 2) was designed, fabricated, and test evaluated laying the groundwork for the construction of a reactor stack. A reactor stack was then designed, fabricated, and successfully test-evaluated to demonstrate the readiness of SPE fual cell technology for future space applications. R.E.S.

N80-27802*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: SEASONAL REPORT FOR CONTEMPORARY-MANCHESTER, MANCHESTER, NEW HAMPSHIRE Progress Report, Mar. 1979 - Feb. 1980
30 Jul. 1980 80 p Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161471) Avail: NTIS HC A05/MF A01 CSCL 10A

The operational and thermal performance of the solar energy system, Contemporary-Manchester, is described. The system was designed by Contemporary Systems Incorporated to provide space heating and domestic hot water preheating for a three story dwelling located on the New Hampshire Vocational Technical College campus, Manchester, New Hampshire. The net fossil energy savings for the period from March, 1979 to February, 1980 was 14.52 million Btu. However, the performance of the system must be degraded due to the fact that the building was unoccupied throughout the data assessment and analysis period. The unoccupied status prevented the normal adjustment of heating and ventilating controls for maintenance of comfort levels within the building. This lack of occupancy also prevented the typical family hot water usage, which would have allowed for more realistic evaluation of the hot water subsystem. R.E.S.

N80-27803*# Wichita State Univ., Kans.
FEASIBILITY STUDY OF AILERON AND SPOILER CONTROL SYSTEMS FOR LARGE HORIZONTAL AXIS WIND TURBINES Final Report
W. H. Wentz, Jr., M. H. Snyder, and J. T. Calhoun May 1980 69 p refs
(Grant NsG-3277; Contract EX-76-I-01-1028)
(NASA-CR-159856; DOE/NASA/3277-1; WER-10) Avail: NTIS HC A04/MF A01 CSCL 10A

The feasibility of using aileron or spoiler controls as alternates to pitch control for large horizontal axis wind turbines was studied. The NASA Mod-0 100 kw machine was used as the basis for the study. Specific performance studies were conducted for 20% chord ailerons over the outboard 30% span, and for 10% chord spoilers over the same portion of the span. Both control systems utilized control deflections up to 60 deg. Results of the study show that either ailerons or spoilers can provide the control necessary to limit turbine power in high wind conditions. The aileron system, as designed, provides overspeed protection at hurricane wind speeds, low wind speed starting torque of 778 N-m (574 ft. lb) at 3.6 m/sec, and a 1.3 to 1.5% increase in annual energy compared to a fixed pitch rotor. The aileron control system preliminary design study includes aileron loads analysis and the design of a failsafe flyweight actuator for overspeed protection in the event of a hydraulic system failure. L.F.M.

N80-27804*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT ON COMBINED CYCLE EFFICIENCY OF STACK GAS TEMPERATURE CONSTRAINTS TO AVOID ACID CORROSION Final Report
Joseph J. Nainiger Jul. 1980 16 p refs
(Contract EF-77-A-01-2593)
(NASA-TM-81531; DOE/NASA/2593-17; E-483) Avail: NTIS HC A02/MF A01 CSCL 10B

To avoid condensation of sulfuric acid in the gas turbine exhaust when burning fuel oils contaning sulfur, the exhaust stack temperature and cold-end heat exchanger surfaces must be kept above the condensation temperature. Raising the exhaust

stack temperature, however, results in lower combined cycle efficiency compared to that achievable by a combined cycle burning a sulfur-free fuel. The maximum difference in efficiency between the use of sulfur-free and fuels containing 0.8 percent sulfur is found to be less than one percentage point. The effect of using a ceramic thermal barrier coating (TBC) and a fuel containing sulfur is also evaluated. The combined-cycle efficiency gain using a TBC with a fuel containing sulfur compared to a sulfur-free fuel without TBC is 0.6 to 1.0 percentage points with air-cooled gas turbines and 1.6 to 1.8 percentage points with water-cooled gas turbines. Author

N80-27805*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPACT OF PROPULSION SYSTEM R AND D ON ELECTRIC VEHICLE PERFORMANCE AND COST
Harvey J. Schwartz and Andrew L. Gordan 22 May 1980 16 p refs Presented at 3d Intern. Electric Vehicle Exposition and Conf., St. Louis, 20-22 May 1980
(Contract EC-77-A-31-1044)
(NASA-TM-81548; DOE/NASA/1044-9; E-504) Avail: NTIS HC A02/MF A01 CSCL 10B

The efficiency, weight, and manufacturing cost of the propulsion subsystem (motor, motor controller, transmission, and differential, but excluding the battery) are major factors in the purchase price and cost of ownership of a traffic-compatible electric vehicle. The relative impact of each was studied, and the conclusions reached are that propulsion system technology advances can result in a major reduction of the sticker price of an electric vehicle and a smaller, but significant, reduction in overall cost of ownership. L.F.M.

N80-27806*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION-SEASONAL REPORT FOR ELCAM SAN DIEGO, SAN DIEGO, CALIFORNIA Progress Report, Mar. - Sep. 1979
May 1980 71 p refs Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161481) Avail: NTIS HC A04/MF A01 CSCL 10A

The solar energy system, Elcam San Diego, was designed to supply domestic hot water heating for a single family residence located in Encinitas, California. System description, performance assessment, operating energy, energy savings, maintenance, and conclusions are presented. The system is a 'Sunspot' two tank cascade type, where solar energy is supplied to either a 66 gallon preheat tank (solar storage) or a 40 gallon domestic hot water tank. Water is pumped directly from one of the two tanks, through the 65 square feet collector array and back into the same tank. Freeze protection is provided by automatically circulating hot water from the hot water tank through the collectors and exposed plumbing when freezing conditions exist. Auxiliary energy is supplied by natural gas. Analysis is based on instrumented system data monitored and collected for one full season of operation. L.F.M.

N80-27807*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ASHMET: A COMPUTER CODE FOR ESTIMATING INSOLATION INCIDENT ON TILTED SURFACES
Robert F. Elkin and Ronald G. Toelle May 1980 44 p refs Sponsored in part by DOE
(NASA-TM-78286) Avail: NTIS HC A03/MF A01 CSCL 10A

A computer code, ASHMET, was developed by MSFC to estimate the amount of solar insolation incident on the surfaces of solar collectors. Both tracking and fixed-position collectors were included. Climatological data for 248 U. S. locations are built into the code. The basic methodology used by ASHMET is the ASHRAE clear-day insolation relationships modified by a clearness index derived from SOLMET-measured solar radiation data to a horizontal surface. L.F.M.

N80-27808*# Spectrolab, Inc., Sylmar, Calif.
SCREEN PRINTING TECHNOLOGY APPLIED TO SILICON SOLAR CELL FABRICATION Final Report, Nov. 1977 - Feb. 1979
Jay W. Thornhill and William E. Sipperly Apr. 1980 64 p refs
(Contract NAS3-20826)
(NASA-CR-159789) Avail: NTIS HC A04/MF A01 CSCL 10A

The process for producing space qualified solar cells in both the conventional and wraparound configuration using screen printing techniques was investigated. Process modifications were chosen that could be easily automated or mechanized. Work was accomplished to optimize the tradeoffs associated with gridline spacing, gridline definition and junction depth. An extensive search for possible front contact metallization was completed. The back surface field structures along with the screen printed back contacts were optimized to produce open circuit voltages of at least an average of 600 millivolts. After all intended modifications on the process sequence were accomplished, the cells were exhaustively tested. Electrical tests at AMO and 28 C were made before and after boiling water immersion, thermal shock, and storage under conditions of high temperature and high humidity. L.F.M.

N80-27809*# Boeing Aerospace Co., Seattle, Wash.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. VOLUME 1: EXECUTIVE SUMMARY, PHASE 3 Final Report, Dec. 1979 - May 1980
Jun. 1980 69 p refs 5 Vol.
(Contract NAS9-15636)
(NASA-CR-160742; D180-25969-1-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 10A

Results of a three phase study of the Solar Power Satellite System are summarized. Various options and alternate systems were considered and the following conclusions were reached: antenna mounted solid state transmitters are potentially as cost effective as the klystron approach, although limited to 2500 megawatts net output; the free electron laser and optical diode laser appear most promising for laser power transmission; ground antenna siting need not be restricted to below 35 degrees of latitude; and nonrecurring cost reductions attainable by using a smaller Heavy Lift Launch Vehicle are highly attractive. L.F.M.

N80-27810*# Boeing Aerospace Co., Seattle, Wash.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. VOLUME 2, PART 3: FINAL BRIEFING, 16 MAY 1980, PHASE 3
Jun. 1980 410 p 5 Vol.
(Contract NAS9-15636)
(NASA-CR-160743; D180-25969-2-Vol-2) Avail: NTIS HC A18/MF A01 CSCL 10A

Alternatives to the microwave transmission system previously defined Solar Power Satellite Systems were investigated. These were the laser power transmission, transportation systems, and an analysis or solid state power transmission. The advantages of each system are presented. F.O.S.

N80-27811*# Boeing Aerospace Co., Seattle, Wash.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. VOLUME 3: LASER SPS ANALYSIS, PHASE 3 Final Report, Dec. 1979 - May 1980
Jun. 1980 99 p refs 5 Vol.
(Contract NAS9-15636)
(NASA-CR-160744; D180-25969-3-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 10A

The potential use of lasers for transmitting power to Earth from Solar Power Satellites was examined. Free electron lasers appear most promising and would have some benefits over microwave power transmission. Further research in laser technology is needed. L.F.M.

N80-27812*# Boeing Aerospace Co., Seattle, Wash.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. VOLUME 4: SOLID STATE SPS ANALYSIS, PHASE 3 Final Report, Dec. 1979 - May 1980
Jun. 1980 79 p 5 Vol.
(Contract NAS9-15636)
(NASA-CR-160745; D180-25969-4-Vol-4) Avail: NTIS HC A05/MF A01 CSCL 10A

A 2500 megawatt solid ground output Solar Power Satellite (SPS) of conventional configuration was designed and analyzed. Because the power per receiving antenna is halved, as compared

with the klystron reference, twice the number of receiving antennas are needed to deliver the same total power. The solid state approach appears feasible with a slightly greater specific mass and slightly higher cost than the klystron SPS design. L.F.M.

N80-27813*# Boeing Aerospace Co., Seattle, Wash.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. VOLUME 5: SPACE TRANSPORTATION ANALYSIS, PHASE 3 Final Report, Dec. 1979 - May 1980
Jun. 1980 153 p refs 5 Vol.
(Contract NAS9-15636)
(NASA-CR-160746; D180-25969-5-Vol-5) Avail: NTIS HC A08/MF A01 CSCL 10A

A small Heavy Lift Launch Vehicle (HLLV) for the Solar Power Satellites (SPS) System was analyzed. It is recommended that the small HLLV with a payload of 120 metric tons be adopted as the SPS launch vehicle. The reference HLLV, a shuttle-derived option with a payload of 400 metric tons, should serve as a backup and be examined further after initial flight experience. The electric orbit transfer vehicle should be retained as the reference orbit-to-orbit cargo system. L.F.M.

N80-27814# Defence Research Establishment, Ottawa. (Ontario).
EVALUATION OF THE VERTICAL AXIS WIND TURBINE AT DREO
Howard R. Braun, David J. Bristow, and Sylvia J. Wake Jan. 1980 100 p refs
(AD-A083961; DREO-R-822) Avail: NTIS HC A05/MF A01 CSCL 10/2

A Vertical Axis Wind Turbine-Battery Storage System was installed at the Defence Research Establishment Ottawa (DREO) in December 1975 and was operated for three years. The system was instrumented to control and monitor its operation and performance. This report deals with an evaluation study of a Vertical Axis Wind Turbine-Battery Storage System for a low-power unattended power source. The System's wind turbine, energy-generating and battery-storage system, mechanical drive system, installation, control-circuitry and data-acquisition system are described. Also, a performance-history outlining the problem areas encountered and a data-summary of two years of performance-data acquired during this study are presented. The objective of this study was to assess the System's ability to provide sixty watts of continuous power. The frequency of mechanical failures, especially in the turbine electrical drive system, made this particular system unsuitable as an unattended power source. It was also concluded that the average annual wind speed in the test location was of insufficient magnitude to provide the specified power output. GRA

N80-27815# Defence Research Establishment, Ottawa. (Ontario).
INVESTIGATION OF CADMIUM SELENIDE PHOTOELECTROCHEMICAL CELLS
Robert A. Sawchuk and David R. Snelling Jan. 1980 69 p refs
(AD-A083690; DREO-TN-80-4) Avail: NTIS HC A04/MF A01 CSCL 10/3

Three photoelectrochemical devices, developed at Simon Fraser University, employing electrochemically deposited cadmium selenide photoanodes, a polysulphide redox electrolyte and an in situ energy storage compartment were evaluated at DREO. The photoelectrochemical devices were initially tested using tungsten filament lamps, and the evaluation was completed with a xenon lamp which closely matched a solar spectrum corresponding to AM1 (air mass 1) conditions having an irradiance level of 2/889 Wm. Maximum power output of the devices was in the 10-20 mW range resulting in a solar (AM1) to electrical conversion efficiency of less than 1%. A fill-factor approaching 0.25 was typical for the photoelectrochemical cells examined. Counter electrode polarization and electrolyte light absorption were identified and evaluated as efficiency limiting factors. Proposed loss mechanisms are: series resistance in the semiconductor bulk, electron tunneling to surface states, current carrier losses at electron-hole recombination centers, and shorting to the nickel substrate. The concept of in situ energy storage was not successfully demonstrated. It is concluded that counter electrode polarization can be overcome and that further research is required in order to detect the presence of surface states and electron-hole recombination centers as well as research oriented to characterize the structure of the depletion layer and the CdSe/electrolyte interface. The efficiency of the electrochemically deposited CdSe should approach the 5-10% efficiency observed for single crystal and pressure sintered CdSe. GRA

N80-27816# Defense Intelligence Agency, Washington, D.C.
HYDROGEN TECHNOLOGY: FOREIGN, CHANGE 1 Report for period ending Feb. 1980
James D. Busi and Phillip Greenbaum 14 Apr. 1980 66 p
(AD-A083665; DIA-DST-1860S-522-78-CHG-1) Avail: NTIS HC A04/MF A01 CSCL 10/2

Hydrogen is both a promising medium for the efficient storage and transmission of energy and a potential alternate fuel. Hydrogen is not a primary energy source, however, since its production is dependent upon other energy sources (thermal, electrical, and radiant). To be practicable as a fuel, hydrogen must be produced in bulk quantities with a standardized purity that will satisfy consumer specifications. In addition, improved distribution systems must make hydrogen widely available to military, industrial, and domestic consumers if the successful evolution of a hydrogen economy is to occur. The greatest potential military impact of hydrogen lies in its use as an aviation fuel. Because of its high specific energy (124 kJ/kg--2.7 times greater than conventional aviation fuels), hydrogen has potential use as a fuel for subsonic transports, supersonic aircraft, and helicopters; however, safety measures, logistics, and storage and handling systems must be developed and standardized before this capability can be achieved. Initial experimental use of hydrogen in military aircraft may occur in the 1980s. A followup conversion and modification of aircraft and airports to hydrogen will require an additional 10 to 15 years. Secondary military interests include the use of hydrogen fuel cells for portable and transportable power generation, and its use as a propellant in aerospace applications. GRA

N80-27817# Battelle Pacific Northwest Labs., Richland, Wash.
WIND CHARACTERISTICS FOR DESIGN OF WIND TURBINES: RESEARCH IN THE USA
J. R. Connell 1 Dec. 1979 22 p Presented at the IEA Meeting, Stockholm, 12-13 Sep. 1979
(Contract EY-76-C-06-1830)
(PNL-SA-7967; CONF-7909128-1) Avail: NTIS HC A02/MF A01

The Pacific Northwest Laboratory (PNL) of the United States Department of Energy has the primary responsibility for providing information on wind characteristics for design and for evaluation of performance of wind energy conversion systems (WECS). The objectives of the whole program are, broadly, to develop technical wind information which is relevant to the design of WECS, to determine suitable methods of measuring and analyzing the wind for evaluating WECS performance, and to communicate the information usefully to WECS designers. DOE

N80-27818# Technical Univ. of Denmark, Lyngby. Thermal Insulation Lab.
INVESTIGATION OF HEAT STORAGES WITH SALT HYDRATE AS STORAGE MEDIUM BASED ON THE EXTRA WATER PRINCIPLE
S. Furbo 1980 83 p refs
(EUR-6646-Pt-2) Avail: NTIS (US Sales Only) HC A05/MF A01; DOE Depository Libraries

Experimental and computational studies of a full scale heat storage with salt hydrate as storage medium and based on the extra water principle are reported. Two different types of full scale heat storage, both making use of an incongruently melting salt hydrate as storage medium and based on the extra water principle, were examined by means of long term experiments. No decrease in the performance of the storages during the long term experiments was observed, and experiences for both storage types are obtained. By means of computer calculations, heat of fusion storage with oil as the heat transfer fluid in direct contact with the storage medium were compared with hot water storage as part of solar heating systems with the Danish Reference Year as a basis. With results of these calculations, examples of economical comparisons between heat of fusion storage and hot water storages are carried out. DOE

N80-27819# Lockheed Missiles and Space Co., Palo Alto, Calif.
AMORPHOUS THIN FILMS FOR SOLAR CELL APPLICA-

TION Quarterly Report, 1 Oct. - 31 Dec. 1979
A. D. Jonath, K. M. Monahan, J. L. Crowley, and H. F. MacMillan 1979 17 p refs
(Contract DE-AC03-79ET-23040)
(DOE/ET-23040-3; QR-3) Avail: NTIS HC A02/MF A01

The identification content and role of impurities in alpha Si thin films was investigated. Emphasis was on the measurement of oxygen concentration profiles through the film using Rutherford backscattering and nuclear reaction methods and the control over oxygen inclusion in the sputtered films. DOE

N80-27820# Sandia Labs., Livermore, Calif. Materials Development Div.
HYDROGEN COMPATIBILITY OF STRUCTURAL MATERIALS FOR ENERGY STORAGE AND TRANSMISSION Annual Report, 1 Oct. 1978 - 30 Sep. 1979
W. R. Hoover, J. J. Iannucci, S. L. Robinson, J. R. Spingarn, and R. E. Stoltz Feb. 1980 70 p refs
(Contract EY-76-C-04-0789)
(SAND-80-8202) Avail: NTIS HC A04/MF A01

This annual report documents the activities and contributions accomplished during FY79 on a research contract aimed at assessing the feasibility of transporting hydrogen gas through the existing natural gas pipeline network. Studies of the hydrogen-induced degradation of pipeline steels reveal that hydrogen can be transported in these steels if a number of precautions are taken. These issues are discussed and plans for further research are presented. DOE

N80-27821# SRI International Corp., Menlo Park, Calif.
COMMUNITY IMPEDIMENTS TO IMPLEMENTATION OF SOLAR ENERGY
M. D. Armstrong and J. E. Armstrong Nov. 1979 112 p refs
(Contract W-7405-eng-48)
(DOE/EV-0059) Avail: NTIS HC A06/MF A01

The complete array of institutional problems expected to emerge when solar technology is implemented on a national scale is assembled. The findings of the study are presented in two formats. First, the results are organized by the time frames of delays in solar implementation caused by the inherent difficulties a national energy policy would encounter in changing the way a given institution responds to specific solar technologies. Delay categories of 10 years or more, 6 to 8 years, and 3 to 5 years were selected; all were assigned under the assumption that a strong national policy promoting adoption of solar technologies would be in effect. The second format constitutes a description of the difficulties at the community level, associated with implementing each solar technology. DOE

N80-27822# Midwest Research Inst., Golden, Colo.
HETEROJUNCTION SOLAR CELLS
S. Wagner 1978 17 p refs Presented at Royal Soc. Discussion Meeting on Solar Energy, London, 15 Nov. 1978
(Contract EG-77-C-01-4042)
(SERI/TP-32-134; CONF-7811142-1) Avail: NTIS HC A02/MF A01

A qualitative description of semiconductor/semiconductor heterojunction solar cells is given. The two groups of heterojunctions of greatest economic potential, very highly efficient cells for concentrator applications and moderately efficient thin film cells for flat plates, are described with examples. These examples illustrate the role of heterojunctions in surface passivation, monolithic multijunction devices, devices with semiconductors of only one conductivity type, and low-temperature fabrication techniques. DOE

N80-27823# National Technical Information Service, Springfield, Va.
SOLAR PROCESS HEAT. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1980
Audrey S. Hundemann Apr. 1980 67 p
(PB80-807936) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 10A

Feasibility, design, cost, and economic potential of solar process heat are discussed. Potential applications to industries using hot water or steam and to heat used for dehydration processes in agriculture are covered. Contains 60 abstracts.GRA

N80-27824# Idaho Univ., Moscow. Water Resources Research Inst.
UNDEVELOPED HYDROPOWER AS A POTENTIAL ENERGY SOURCE IN IDAHO
C. C. Warnick and L. F. Heitz Nov. 1979 28 p refs
(PB80-157399; WB0-03918; OWRT-A-057-IDA(2)) Avail: NTIS HC A03/MF A01 CSCL 10B

The potential energy available in both regulated and unregulated streams in Idaho and the Pacific Northwest through the use of small scale hydro development was surveyed. For the survey a technique was developed to find low duration information along reaches of streams that do not have flow records due to inadequate gaging. Also a method for estimating flow duration curves for regulated streams was developed and applied. To determine head for power computations the difference in elevation at the inflow and outflow points of a reach was used. A preliminary social, political, and environmental feasibility evaluation was also made for each reach with theoretical energy potential. Summaries of the survey results are included. GRA

N80-27825# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
ENERGY PROGRAMS AT THE JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY Quarterly Report, Oct. - Dec. 1979
Feb. 1980 49 p refs
(Contracts EX-76-A-36-1008; DE-AI01-79ET-27025)
(PB80-163686; JHU/APL/EQR/79-4) Avail: NTIS HC A03/MF A01 CSCL 10A

Work on various tasks to develop energy resources, utilization concepts, and storage methods is summarized. Reports are presented in the following areas: geothermal prospecting; hydroelectric power generation in southeastern states; neotectonic investigations in Connecticut; ocean thermal energy conversion core unit testing and recovery of landfill methane; and unconventional gas sources--Eastern devonian shales. R.E.S.

N80-27826# National Bureau of Standards, Washington, D.C. National Engineering Lab.
EVALUATION OF A PROPOSED ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS) STANDARD GUIDE TO ASSESS THE COMPATIBILITY OF METAL-HEAT TRANSFER LIQUID PAIRS IN SOLAR HEATING AND COOLING SYSTEMS
Paul Wencil Brown and John W. Grimes, II Nov. 1979 46 p refs Sponsored in part by DOE
(PB80-161748; NBSIR-79-1919) Avail: NTIS HC A03/MF A01 CSCL 13A

A proposed testing methodology for laboratory screening of metallic containment materials for use with liquids in solar heating and cooling systems was evaluated with emphasis on the procedural aspects of each test method. It was determined that the tests described in this standard practice can be carried out as a basis for evaluating metal-heat transfer liquid pair interactions under conditions simulative of various modes of solar containment system operation. GRA

N80-27827# National Bureau of Standards, Washington, D.C. National Engineering Lab.
ANALYSIS OF CODE RELATED RESPONSES FROM THE SOLAR DEMONSTRATION PROGRAM Final Report
Jan. 1980 156 p Sponsored in part by HUD and DOE
(PB80-153968; NBSIR-79-1957) Avail: NTIS HC A08/MF A01 CSCL 10A

The building regulatory information gathered during the course of the Residential Solar Demonstration Program from inception of the program through September 30, 1978 is documented. It is concluded that existing codes do not present a barrier to the installation and acceptance of solar systems; however, code officials need additional training and better back-up material to properly evaluate solar systems. GRA

N80-27828# New Mexico Energy Inst., Albuquerque.
DEVELOPMENT OF A LOW-COST NON-TRACKING HEAT PIPE CONCENTRATING COLLECTOR Final Report, 1 Jul. 1978 - 30 Jun. 1979
K. T. Feldman, Jr. and Darryl Lee Noreen Jul. 1979 182 p refs Sponsored in part by New Mexico Energy and Minerals

Dept.
(PB80-160443; NMEI-23) Avail: NTIS HC A09/MF A01 CSCL 13A

A solar water heater which uses a multi-heat-pipe energy absorber is discussed. In the absorber configuration, wickless heat pipes which rely on only gravity and a puddle-flow mechanism are used. In order to design an energy absorber with sufficient heat transfer capability, the performance of a puddle-flow gravity-assisted heat pipe is theoretically investigated. The maximum heat transport capability of methanol, water, and Freon-11 heat pipes was studied. The relationship between various heat pipe parameters and axial heat transport capability is discussed. GRA

N80-27829# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
AN INVESTIGATION OF WIND LOADS ON SOLAR COLLECTORS. APPENDIX 2: NET PRESSURE COEFFICIENTS Final Report
H. W. Tieleman, R. E. Akins, and P. R. Sparks Jan. 1980 170 p
(Contract EO-A01-78-3605)
(PB80-158769; VPI-E-80-1-App-2) Avail: NTIS HC A08/MF A01 CSCL 10A

A wind tunnel study of a series of model solar collector installations (flat-plate collectors) immersed in a thick turbulent shear layer was undertaken in order to determine design wind loads on such installations. Wind tunnel measurements were made of the mean and fluctuating pressures on a model of a single flat plate collector which was a component of different multipanel installations. The pressures were spatially integrated over the top and bottom of the single collector separately. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-27830 Maryland Univ., College Park.
THE COMPOSITION, SOURCES AND SINK OF SOUTH POLAR AEROSOLS Ph.D. Thesis
William Charles Cunningham 1979 459 p
Avail: Univ. Microfilms Order No. 8016345

In order to develop a better understanding of global aerosol transport processes background aerosols collected at the South Pole were studied. The composition of South Polar aerosols was approximately the same over a period of seven years, but there were strong seasonal variations in aerosol source strengths. Sources that are significant contributors to the South Polar aerosols include the stratospheric sulfate layer, the seas, the Earth's crust, meteorites and, possibly, volcanoes. Comparisons of the seasonal variations in source component concentrations with one another and with radioisotopic tracers of stratospheric origin indicated specific transport mechanisms. Crustal material and sea salt are transported to the South Pole via the troposphere. Sulfate and meteoritic debris enter the troposphere at some distance from the South Pole and mix with tropospheric air during transport. Ice-crystal formation was found to effectively remove crustal and marine aerosols. Dissert. Abstr.

N80-27831 California Univ., Los Angeles.
A NUMERICAL INVESTIGATION OF THE EFFICIENCY WITH WHICH AEROSOL PARTICLES COLLIDE WITH CLOUD AND SMALL RAIN DROPS Ph.D. Thesis
Solomon Norman Grover 1980 299 p
Avail: Univ. Microfilms Order No. 8015981

A numerical investigation of the scavenging of aerosol particles by cloud and rain drops is presented. A numerical model which calculates collision efficiencies for drops colliding with particles was developed and applied to a wide variety of cases naturally occurring in the atmosphere. The model deduces the collision efficiency by integrating particle trajectories relative to the collector drop using a stable fourth order predictor-corrector scheme. Effects included are those due to the particle's inertia, the air flow pattern around the falling collector drop, electric forces which exist when external electric fields or charges on the drop and particle are present, and thermo-diffusiophoretic forces which arise when the relative humidity is below 100%. Dissert. Abstr.

N80-27832*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COORDINATED AIRCRAFT AND SHIP SURVEYS FOR DETERMINING IMPACT OF RIVER INPUTS ON GREAT LAKES WATERS. REMOTE SENSING RESULTS
Charles A. Raquet, Jack A. Salzman, Thom A. Coney, Roger A. Swahla, Donald F. Shook, and Richard T. Gedney Jul. 1980 105 p refs
(NASA-TP-1694; E-172) Avail: NTIS HC A06/MF A01 CSCL 13B

The remote sensing results of aircraft and ship surveys for determining the impact of river effluents on Great Lakes waters are presented. Aircraft multi-spectral scanner data were acquired throughout the spring and early summer of 1976 at five locations: the West Basin of Lake Erie, Genesee River - Lake Ontario, Menomonee River - Lake Michigan, Grand River - Lake Michigan, and Nemadji River - Lake Superior. Multispectral scanner data and ship surface sample data are correlated resulting in 40 contour plots showing large-scale distributions of parameters such as total suspended solids, turbidity, Secchi depth, nutrients, salts, and dissolved oxygen. The imagery and data analysis are used to determine the transport and dispersion of materials from the river discharges, especially during spring runoff events, and to evaluate the relative effects of river input, resuspension, and shore erosion. Twenty-five LANDSAT satellite images of the study sites are also included in the analysis. Examples of the use of remote sensing data in quantitativley estimating total particulate loading in determining water types, in assessing transport across international boundaries, and in supporting numerical current modeling are included. The importance of coordination of aircraft and ship lake surveys is discussed, including the use of telefacsimile for the transmission of imagery. J.M.S.

N80-27833*# National Aeronautics and Space Administration, Washington, D. C.
ANNOYANCE DUE TO NOISE AND AIR POLLUTION TO THE RESIDENTS OF HEAVILY FREQUENTED STREETS
H. U. Wanner, Brigit Wehrli, J. Nemecek, and V. Turrian Apr. 1980 23 p refs Transl. into ENGLISH from Sozial und Praeventivmedizin, Zurich v. 22, 1977 p 103-122 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75496) Avail: NTIS HC A02/MF A01 CSCL 13B

The residents of different streets with varying traffic density and building density were questioned about annoyance due to traffic noise and air pollution. Results show that annoyance felt is dependent not only on the measured noise levels and/or air pollution concentrations, but that there do exist interactions between the residential quarters and annoyance. These interactions should be considered when fixing the limits and standards.
Author

N80-27834*# National Aeronautics and Space Administration, Washington, D. C.
NOISE LEVELS NEAR STREETS, EFFECTIVENESS AND COST ABATEMENT MEASURES
Judith Lang Apr. 1980 11 p refs Transl. into ENGLISH of conf. paper "Laermbelastung an Strassen, Wirksamkeit und Kosten von Laermschutzmassnahmen" Vienna, OAL-Fachtagung p 156-162 Presented at Tech. Conf. of the OEAL, Vienna, 1978 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75814) Avail: NTIS HC A02/MF A01 CSCL 13B

During the years 1975-1978, research was carried concerning the current noise levels near streets, the annoyance felt by the population, possible noise abatement measures for these streets, and the economic impact of such measures. The results of the research are summarized. R.E.S.

N80-27835*# National Aeronautics and Space Administration, Washington, D. C.
CONSTRUCTION AND APPLICATION OF A QUESTION-

NAIRE FOR THE SOCIAL SCIENTIFIC INVESTIGATION OF ENVIRONMENTAL NOISE EFFECTS

R. Guski, U. Wichmann, B. Rohrmann, and H. O. Finke May 1980 29 p refs Transl. into ENGLISH from Z. fur Sozialpsychologie (West Germany) v. 9, 1978 p 50-65 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75492) Avail: NTIS HC A03/MF A01 CSCL 13B

A social psychological questionnaire was developed to study the effects of environmental noise and was applied to 636 people living in 19 different areas of Hamburg. The theoretical foundations and the statistical means employed in its development are described. Four main reactions to noise are isolated statistically, and it is determined that these are moderated by several intervening variables, chief of which are coping capacity for noise, the perceived dangerousness of the noise source, other daily loads, and the individual's lability. Author

N80-27836*# University of Central Florida, Orlando. Dept. of Biological Sciences.

A CONTINUATION OF BASE-LINE STUDIES FOR ENVIRONMENTALLY MONITORING SPACE TRANSPORTATION SYSTEMS AT JOHN F. KENNEDY SPACE CENTER. EXECUTIVE SUMMARY Report, Jun. 1976 - Mar. 1979

I. J. Stout Jul. 1980 133 p refs
(Contract NAS10-8986)
(NASA-CR-163122; KSC-TR-51-2) Avail: NTIS HC A07/MF A01 CSCL 13B

Studies conducted in and around John F. Kennedy Space Center, Merrit Island, Florida were designed to establish baseline conditions for various attributes of the biotic and abiotic environment. Features were described and quantitatively measured. Certain condition were found to be appropriate for the detection and assessment of possible environmental perturbations caused by future NASA activities. These include plant communities, mammal populations, rainfall chemistry, fish populations, and the status of rare and endangered species. On the basis of statistical analysis of quantitative data and logistic considerations, it was possible to refine the kinds and amounts of measurements needed to evaluate perturbations in selected environmental components. F.M.

N80-27837# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

COMMUNITY NOISE EXPOSURE RESULTING FROM AIRCRAFT OPERATIONS. VOLUME 7: ACOUSTIC DATA ON AIRCRAFT GROUND RUNUP NOISE SUPPRESSORS

Robert A. Lee Dec. 1979 282 p
(AF Proj. 7231)
(AD-A083701; AMRL-TR-73-110-Vol-7) Avail: NTIS HC A13/MF A01 CSCL 01/2

This report presents the results of field measurements of the far-field noise produced on the ground by military aircraft operating inside Grade-2 demountable suppressors during ground runup operations. For these ground runups, data are presented as a function of angle and distance to the aircraft. All of the data are normalized to standard acoustic reference conditions of 59 F temperature and 70% relative humidity. Volume 1 discusses the scope, limitations, and definitions needed to understand and use the volumes containing the noise data. Noise data are presented in this Volume 7 for the following aircraft suppressor systems: A-7 in the AF32A-19 and AF-32A-24 noise suppressors, KC-135A in the modified AF32A-52 noise suppressor, F-4 in the AF32A-14 noise suppressor, F-5 in the AF32A-18 noise suppressor, F-15 in the AF32A-23 noise suppressor, F-16 in the AF32A noise suppressor, F-100 in the AF32A-16 noise suppressor, F-106 in the AF32A-17 noise suppressor, F-111 in the AF32A-13 noise suppressor and T-38 in the AF32A-18 noise suppressor. GRA

N80-27838# Computer Sciences Corp., Arlington, Va.

NOISE ABATEMENT ECONOMIC POLICY ANALYSIS MODEL NAEPAM. VOLUME 2: USER'S GUIDE Final Report, Sep. 1978 - Jul. 1979

Andras Spiegel and Roger A. Shepherd Jul. 1979 162 p 2 Vol.
(Contract DOT-FA78WA-4163)
(AD-A081159; FAA-AEE-79-8-2) Avail: NTIS HC A08/MF A01 CSCL 01/2

The development and evaluation of noise emission charge systems for inducing aircraft noise abatement modifications is described in 'Noise Abatement Economic Policy Analysis Model -- /NAEPAM'. The objective of this User's Guide is to describe the model implementation and to provide the necessary information to analysts who wish to execute the model. GRA

N80-27839# Computer Sciences Corp., Arlington, Va.

NOISE ABATEMENT ECONOMIC POLICY ANALYSIS MODEL NAEPAM, VOLUME 1 Final Report, Sep. 1978 - Jul. 1979

Andras Spiegel and Roger A. Shepherd Jul. 1979 73 p refs 2 Vol.
(Contract DOT-FA79WA-4163)
(AD-A081190; FAA-AEE-79-8-1) Avail: NTIS HC A04/MF A01 CSCL 01/2

This report examines the role of economic disincentive as an inducement to noise abatement. The particular disincentive analyzed is a system of noise emission charges (NEC) which is imposed at airports on commercial aircraft operations which are above maximum noise emission allowances. The methodology developed is in the form of a mathematical programming (MP) model which seeks to minimize the total cost of a disincentive-based policy. Preliminary analyses conducted with the model indicate (qualitatively) that the method of noise emission charges, administered at the airport level on operations exceeding the current noise emission standards, is an economically feasible method for inducing noise abatement. The single most critical assumption underlying this conclusion is that if the NEC administration is voluntary, then a sufficient number of airports must impose the charges. The modeling concept presented is suitable for the analysis of a broad spectrum of aviation economic policy related issues. GRA

N80-27840# Federal Aviation Administration, Washington, D. C. Office of Environment and Energy.

INTEGRATED NOISE MODEL (INM). VERSION 2. USER'S GUIDE

Thomas Connor and Robert Hinckley Sep. 1979 405 p Supersedes FAA-EQ-78-01
(AD-A079493; FAA-AEE-79-09; FAA-EQ-78-01) Avail: NTIS HC A18/MF A01 CSCL 01/2

This document contains the instructions to execute the Integrated Noise Model (INM), Version 2. The INM is a collection of computer programs which can calculate the aircraft noise environment in the vicinity of an airport given certain information on airport location, layout, and the type and movement of its air traffic. GRA

N80-27841# Federal Aviation Administration, Washington, D. C. Office of Environment and Energy.

FEDERAL AVIATION ADMINISTRATION HIGH ALTITUDE POLLUTION PROGRAM, SECOND BIENNIAL REPORT, PREPARED IN ACCORDANCE WITH THE OZONE PROTECTION PROVISION, SECTION 153G, OF THE CLEAN AIR ACT AMENDMENTS OF 1977 Biennial Report, Jan. 1978 - Dec. 1979

N. Sundararaman, W. Smith, and J. Rogers Dec. 1979 64 p refs
(AD-A081520; FAA-EE-79-24) Avail: NTIS HC A04/MF A01 CSCL 13/2

This report was prepared in accordance with the Stratospheric Ozone Protection provisions of Public Law 95-95, the Clean Air Act Amendments of 1977. The impact of high altitude aviation on stratospheric ozone is now believed to be an increase in total columnar ozone for flights up to 20 km (about 66,000 feet). This result has been brought about through improvements in one-dimensional chemical kinetics-transport model of the stratosphere. They show that aircraft-injected pollutants (primarily nitrogen oxides) generate ozone through simplified 'smog' mechanisms in the upper troposhere and lower stratosphere while depleting it through the classic catalytic destruction mechanism at higher altitudes. The net result at present is a slight overall ozone increase. The uncertainty in the present model calculations, however, is unknown. The effort of the High Altitude Pollution Program of the Federal Aviation Administration is aimed at

identifying and resolving the uncertainties so that a 'consensus' method or methods can be obtained for future assessments of the impacts of high altitude aviation on the environment. GRA

N80-27842# Mitre Corp., McLean, Va. Metrek Div.
FAA INTEGRATED NOISE MODEL VALIDATION. PHASE 1: ANALYSIS OF INTEGRATED NOISE MODEL CALCULATIONS FOR AIR CARRIER FLYOVERS
R. G. Gados and J. M. Aldred Dec. 1979 103 p refs
(Contract DOT-FA80WA-4370)
(AD-A081426; MTR-79W; FAA/EE-80-04) Avail: NTIS HC A06/MF A01 CSCL 01/3

The Federal Aviation Administration's Integrated Noise Model is a set of computer programs which is used to predict the noise impact of aircraft in the vicinity of an airport. Through use of extensive statistical analyses, this study investigates the accuracy and suitability of the noise model in calculating aircraft noise exposure by: examining the agreement between the noise model in calculating single noise events and the actual measurement of those events, assessing the sensitivity and controllability of the noise model to aircraft thrust assumptions, and investigating noise curves used in calculating noise exposure by testing variables for significance in estimating noise and by comparing the shape of empirical noise curves with those already in the noise model. Data for the analysis were obtained from field observations of noise from air carrier flight operations over various noise monitoring sites near Washington National and Dulles International Airports. GRA

N80-27843# California Univ., Berkeley. Energy and Environment Div.
LAND USE AND ENVIRONMENTAL IMPACTS OF DECENTRALIZED SOLAR ENERGY USE
Robert H. Twiss, Patricia L. Smith, Allen E. Gatzke, and Scott T. McCreary Jan. 1980 206 p refs
(Contract W-7405-eng-48)
(DOE/EV-0067) Avail: NTIS HC A10/MF A01

The physical, spatial and land-use impacts of decentralized solar technologies applied at the community level by the year 2000 are examined. The results are intended to provide a basis for evaluating the way in which a shift toward reliance on decentralized energy technologies may eventually alter community form. Six land-use types representative of those found in most US cities are analyzed according to solar penetration levels identified in the maximum solar scenario for the year 2000. The scenario is translated into shares of end use demand in the residential, commercial and industrial sectors. These proportions become the scenario goals to be met by the use of decentralized solar energy systems. The percentage of total energy demand is assumed to be 35.5 percent, 18.8 percent and 22.6 percent in the residential, commercial and industrial sectors respectively. The community level scenario stipulated that a certain percentage of the total demand be met by on-site solar collection, i.e. photovoltaic and thermal collectors, and by passive design. This on-site solar goal is 31.9 percent (residential), 16.8 percent (commercial) and 13.1 percent (industrial). DOE

N80-27844# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
DRAFT RECOMMENDED PRACTICE FOR MEASUREMENT OF GASEOUS AND PARTICULATE EMISSIONS FROM HEAVY-DUTY DIESEL ENGINES UNDER TRANSIENT CONDITIONS
Eugene Danielson Apr. 1979 86 p
(PB80-153943; EPA-AA-SDSB-79-18) Avail: NTIS HC A05/MF A01 CSCL 13B

The equipment required and the procedures to be followed in measuring exhaust emissions from heavy-duty diesel engines are described. For clarity and continuity, this document is structured to be totally compatible with the proposed heavy-duty gaseous emission regulations. It should be noted that: (1) this procedure does not negate or adversely affect the proposed heavy-duty regulations, but merely specifies the additional equipment and steps necessary for diesel particulate testing; and (2) this format incorporates diesel particulate testing for the 1983 and later model years. Sections in the proposed heavy-duty gaseous emission regulations which are affected by the incorporation of particulate testing are included. GRA

N80-27845# Cambridge Systematics, Inc., Mass.
TRANSPORTATION AIR QUALITY ANALYSIS - SKETCH PLANNING METHODS. VOLUME 2: CASE STUDIES Final Report
Dec. 1979 334 p Sponsored by Urban Mass Transportation Admin., Washington, D.C. and EPA, Washington, D.C. 2 Vol.
(Contract EPA-68-01-4977)
(PB80-158710; EPA-400/1-80-001B-Vol-2) Avail: NTIS HC A15/MF A01 CSCL 13B

Case studies illustrating the application of a selection of techniques for transportation-air quality planning are presented. The analysis approaches illustrated should be useful in developing the transportation portions of State Implementation Plans, as required to meet national ambient air quality standards under the Clean Air Act, as amended. The effects these measures should have on travel; the transportation system; energy conservation; and a host of other social, environmental, economic, and financial concerns; as well as on air quality was evaluated within a broadly participatory, interactive planning process. GRA

N80-27846# West Virginia Univ., Morgantown. Water Research Inst.
FUNCTIONAL POLYMERS FOR REMOVAL OF HEAVY-METAL POLLUTANTS FROM WATER
Anthony Winston, Darrell G. Kirchner, and James W. Rosthauser 1980 48 p refs
(Contract DI-14-34-0001-8052)
(PB80-158215; Information-13; WRI-WVU-80-01; W80-03911; OWRT-A-031-WVA(1)) Avail: NTIS HC A03/MF A01 CSCL 13B

Polymeric ion-exchange resins specific for metal ions and for systems for removing iron from water were designed. The resins are vinyl polymers bearing hydroxamic acids and have strong affinity for iron. Polymers were prepared in which the spacing of the hydroxamic acids were varied. The stability constants of the iron complexes showed that the spacing of the hydroxamic acids was important both in complex stability and in the selectivity of the resin for iron. Polymers for binding copper and mercury were synthesized and evaluated. The functional group for copper was the tripeptide glycylglycylhistidine. For mercury, polymers containing sulfide were studied. Preliminary evaluation showed that the polymers formed complexes with copper and mercury. Various applications of these resins in environment, health, and industry are suggested. GRA

N80-27847# Southern Research Inst., Birmingham, Ala.
CONTROL OF PARTICULATE EMISSIONS IN THE PRIMARY NONFERROUS METALS INDUSTRIES Final Report
Richard L. Meek, ed. Dec. 1979 515 p refs Symp. held at Monterey, Calif., 18-21 Mar. 1979
(Grant EPA-R-804955)
(PB80-151822; EPA-600/2-79-211) Avail: NTIS HC A22/MF A01 CSCL 13B

Foreign and domestic technology applicable to copper, lead, zinc and aluminum is described. Advanced technology, measurement techniques, and current EPA programs that are pertinent to particulate control in the nonferrous metals industry are discussed. GRA

N80-27848# Battelle Columbus Labs., Ohio.
CHARACTERIZATION OF PRIORITY POLLUTANTS FROM AN AIRPLANE PARTS MANUFACTURING FACILITY Final Report, Jan. - Dec. 1978
A. K. Reed, M. A. Eischen, M. M. McKown, and G. R. Smithson, Jr. Jan. 1980 44 p refs
(Contract EPA-68-03-2552)
(PB80-151566; EPA-600/2-80-019) Avail: NTIS HC A03/MF A01 CSCL 13B

Wastewater from an airplane parts manufacturing plant was sampled using the U.S. EPA screening protocol for the 129 priority pollutants. The results of the study show that the treatment practiced at this site removes more than 90 percent of the chromium and zinc and 70 percent of the copper. The system is slightly less effective for cadmium because of its low concentration in the influent to the treatment plant. Nevertheless, in excess of 60 percent of the cadmium is removed. Because of the extremely low concentrations of other metals in the influent to the treatment plant, the effectiveness of the treatment for

their removal could not be evaluated with any degree of confidence. GRA

N80-27849# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
STUDY OF NEW ENGLAND UTILITIES' PARTICULATE AIR POLLUTION CONTROL FACILITIES TO DETERMINE RELATIVE VIABILITY OF APPROACHES TO UPGRADE AND RETROFIT
James R. Melcher and Peter Zieve Nov. 1979 439 p refs Sponsored by Boston Edison Co., New England Power Service Co. and Northeast Utilities Service Co.
(PB80-154073; MIT-EL-79-017) Avail: NTIS HC A19/MF A01 CSCL 13B

Scenarios were developed that describe the air pollution control requirements of five facilities selected from those owned by the sponsoring utilities. The use of innovative technologies as retrofits was investigated for each. Six innovative technologies were chosen from a review of available literature according to their potential for solving utility emissions problems. GRA

N80-27850# Massachusetts Inst. of Tech., Cambridge. Sea Grant Coll. Program.
THE EFFECTS OF SURFACE PHENOMENA ON THE SPREADING OF OIL ON WATER
Riyaz A. Fazal and Jerome H. Milgram Nov. 1979 73 p refs (Grant NOAA-04-7-158-44074)
(PB80-163629; MITSG-79-31; NOAA-80021405) Avail: NTIS HC A04/MF A01 CSCL 13B

The spreading of fc ur kinds of crude extracted from around the world, as well a the spreading of a mixture of pure hydrocarbons and of diesel fuel is described. It is concluded that spreading effects are not wholly determined by bulk properties, but are also affected by the properties of the individual components in the oil. GRA

N80-27851# Mitre Corp., McLean, Va. METREK Div.
A REVIEW OF STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES: SECONDARY LEAD SMELTERS
John W. Watson and Kathryn J. Brooks Mar. 1979 131 p refs
(Contract EPA-68-02-2526)
(PB80-154065; MTR-7871; EPA-450/3-79-015) Avail: NTIS HC A07/MF A01 CSCL 13B

The current standards are summarized and the status of applicable control technology and the ability of secondary lead smelthers to meet the current standards are examined. Compliance test results are analyzed and a recommendation made to retain the current standard. Information used in this report is based upon data available as of November 1978. GRA

N80-27852# SRI International Corp., Menlo Park, Calif.
REMOTE MEASUREMENTS OF AIR POLLUTANTS Final Report
E. R. Murray and R. L. Byer (Stanford Univ.) Jan. 1980 98 p refs
(Grants NSF GI-38986; NSF AEN-73-10596; NSF ENV-73-10596; NSF ENV-77-10198; SRI Proj. 2687; SRI Proj. 6892)
(PB80-164791; NSF/RA-800014) Avail: NTIS HC A05/MF A01 CSCL 14B

The development and demonstration of laser techniques for performing remote measurements of air pollutants are described. The investigation focused on the differential absorption laser radar or DIAL technique to detect trace constituents of the atmosphere. DIAL system measurements of NO2, SO2, O3, HCl, CH4, N2O, H2O, and CH2=CH2 in various spatial regions demonstrate the feasibility of obtaining remote measurements at high sensitivity and long range using currently available technology. Applications of this research encompass measurement of the environment, exploration of new energy resources, and military uses. Specific applications of the DIAL systems include enforcement of air pollution regulations, testing air pollution models, and explorations of regions of geothermal activity. DIAL systems are being investigated for petroleum exploration. GRA

N80-27853# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Labs.
AIR RESOURCES LABORATORIES ATMOSPHERIC TRANSPORT AND DISPERSION MODEL (ARL-ATAD)
Jerome L. Heffter Feb. 1980 31 p refs
(PB80-163652; NOAA-TM-ERL-ARL-81; NOAA-80030501)
Avail: NTIS HC A03/MF A01 CSCL 13B

The Air Resources Laboratories Atmospheric Transport and Dispersion Model (ATAD) is oriented toward practical application for pollution studies. Each trajectory is calculated using transport winds averaged in a vertical layer. Dispersion calculations are made for the forward trajectories. Standard model output includes tables of transport layer depth, maximum vertical wind shear in the transport layer, and trajectory position. Optional output includes trajectory plots and maps of time averaged surface air concentrations and deposition amounts. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-27854 California Univ., Berkeley.
FINITE ELEMENT MODELLING OF TORSIONAL EIGENVIBRATIONS OF THE EARTH Ph.D. Thesis
James Fairman Stifler 1979 96 p
Avail: Univ. Microfilms Order No. 8014896

A numerical algorithm of how the Earth vibrates was developed. Finite elements allow a realistic three dimensional Earth to be modelled having both radial and lateral variations in seismic properties. Numerical algorithms are produced that yield efficient estimations of the nondegenerate eigenfunctions and eigenfrequencies of this laterally inhomogeneous spheroid. These serve as quite independent alternatives to previous mathematical methods to study this problem. The algorithms rely upon Rayleigh's Variational Principle to solve the finite element eigenproblem. The Earth model used is perfectly elastic and nonrotating. The deviations in eigenfrequencies due to the structural contrasts between the continents and the oceans are found to increase with increasing order of oscillation. The variations of the amplitudes of the eigenfunctions of these oscillations are seen to have a significant global variation. The lower order models show a latitudinal dependence of the amplitudes that would be expected were the Earth a simple ellipsoid. The higher order modes have more longitudinal amplitude dependence as a result of the increased perturbation effects of the continents. Dissert. Abstr.

N80-27855 Cornell Univ., Ithaca, N. Y.
MAGMA MIGRATION Ph.D. Thesis
Judson Lewis Ahern 1979 104 p
Avail: Univ. Microfilms Order No. 8015828

The principles of magma migration by porous flow and convective upwelling are applied to the modeling of the thermal evolution of the moon. Radioactive heat-producing elements are concentrated in the first partial melts formed early in the moon's history. Subsequently, magma migration causes removal of heat-producing elements to the surface. Finite difference thermal modeling of the moon shows this effect to be important. Moon models which are initially hot may have a lower present-day heat flux than colder models. Two distinct melting episodes can arise due to radioactive element distribution. The first of these is responsible for the feldspathic lunar crust; the second melting episode, between 4 and 3 billion years ago, produced the mare basalts. Dissert. Abstr.

N80-27856 Pittsburgh Univ., Pa.
THE PALEOMAGNETISM OF THE CARBONIFEROUS STRATA IN THE NORTHERN APPALACHIAN BASIN WITH APPLICATIONS TOWARD MAGNETOSTRATIGRAPHY Ph.D. Thesis
Stephen John Shulik 1979 305 p
Avail: Univ. Microfilms Order No. 8015327

Rocks from the upper Devonian redbeds through the Pennsylvanian to the contact between the Pennsylvanian Allegheny and Conemaugh Groups from southwestern Pennsylvania and the proposed Pennsylvanian Stratotype in West

Virginia were sampled. The samples were sequentially demagnetized and measured using a superconducting rock magnetometer (SCT). The resulting data produced Virtual Geomagnetic Poles for these rocks. Several different pole groupings were noted: reverse and normal Carboniferous, present day, normal Cretaceous, and equatorial poles which can be interpreted as various combinations of the other four poles. Normal Carboniferous poles are recorded in the lower portion of the Wymp's Gap Limestone (Chesterian) and in the shales between the Lower and Middle Kittanning Coals (Desmoinesian). Dissert. Abstr.

N80-27857 North Carolina Univ. at Chapel Hill.
THE CONTRIBUTION OF OZONE ALOFT TO SURFACE OZONE MAXIMA Ph.D. Thesis
Roy Bruce Evans 1979 310 p
Avail: Univ. Microfilms Order No. 8013939

Three principal sources contribute to urban ozone concentrations: (1) background of baseline concentrations advected into the upwind side of the city; (2) entrainment of left-over ozone trapped above the nocturnal radiation inversion; and (3) the photochemical production of ozone from the reaction of local emissions (hydrocarbons and NOx and advected ozone and precursors. Contributions of these three sources to urban ozone concentrations were estimated by analysis of data collected on seven case days in St. Louis in 1976 as part of the Regional Air Pollution Study (RAPS). For the seven days examined the baseline concentrations being advected into the St. Louis area contributed fractions of the observed maximum O3 concentration ranging from 39% to 60%. Examination of the ambient monitoring data obtained with instrumented helicopters and from a surface monitoring network indicates that the O3 entering St. Louis on the upwind side was mixed downward from aloft and had been transported into the St. Louis area by nighttime winds above the nocturnal radiation inversion. Simulation of three of the seven case days with a physically simple photochemical box model indicates that the mechanism of entrainment is responsible for a relatively minor portion of the maximum city center O3 concentration (between 5 and 9%); advection of the ozone by winds after the breakup of the inversion is an important mechanism, however, contributing more than half of the ozone concentrations observed in the city center for the days modeled. Dissert. Abstr.

N80-27858 Idaho Univ., Moscow.
CAMBRIAN STRATIGRAPHY OF THE LIBBY TROUGH, MONTANA Ph.D. Thesis
Rolf Konrad Aadland 1979 323 p
Avail: Univ. Microfilms Order No. 8012065

Three exposures of Cambrian rocks occur as erosional remnants in the Libby Trough, Montana. The trough is a northwest-southeast striking faulted syncline, located between Thompson Falls and Libby, Montana. Three measured sections were obtained in the southernmost exposure, and one measured section each in the northern exposures. Nine hundred five samples were collected, stabbed, polished and described using a binocular microscope. Ninety representative thin sections were examined to verify the primary rock descriptions. Cambrian rocks throughout western Montana include a basal sandstone overlaid by a succession of two shale and two carbonate units in alternating sequence. Although the measured sections are incomplete, the carbonates can be subdivided into five lithologic units. Quartz arenites of the Flathead Formation (approximately 8 m thick) form the basal unit of the transgressive sequence. Shales with interbeds of shaley sandstones and shaley lime mudstones characterize the Wolsey Shale (approximately 75 m thick). The overlying carbonate sequence (Fishtrap dolomite) is about 915 m thick and is divided into five lithofacies. Dissert. Abstr.

N80-27859 Ohio State Univ., Columbus.
SPECTRAL ANALYSIS OF GEOS-3 ALTIMETER DATA AND FREQUENCY DOMAIN COLLOCATION Ph.D. Thesis
Kamil Eren 1980 157 p
Avail: Univ. Microfilms Order No. 8015872

The mathematical background in spectral analysis as applied to geodetic applications is summarized. In geodetic problems, there are usually discrete and nonperiodic data. The resolution of the GEOS-3 altimeter data was examined by determining the shortest wavelength recoverable. The data from some 18 profiles were used. The total power in the sea surface topography with respect to the reference ellipsoid as well as with respect to the GEM-9 surface was computed. A fast inversion algorithm for matrices of simple and block Toeplitz matrices and its application to least squares collocation is explained. This algorithm yields a considerable gain in computer time and storage in comparison with conventional least squares collocation. Frequency domain least squares collocation techniques are introduced and applied to estimating gravity anomalies from GEOS-3 altimeter data. These techniques also reduce the computer time and requirements in storage associated with the conventional least squares collocation. Dissert. Abstr.

N80-27860 California Univ., Berkeley.
COMPUTER-ORIENTED METHODS FOR ASSESSING RELIABILITY OF COMPLEX SYSTEMS Ph.D. Thesis
Randall Ramon Willie 1979 148 p
Avail: Univ. Microfilms Order No. 8014933

An important task in reliability analysis of a complex system is identification of the logical dependence of system performance on performance of components. An explicit description of this logical dependence, usually in terms of reliability minimal cut and patch set families was studied. These families are useful not only for evaluating reliability characteristics of a system but also as a design tool to guide system modification for enhancing reliability. The first problem to be considered is that of the determining families of critical failure modes when the logical relationship between system failure and failure of its subsystems and components can be modelled effectively as a Boolean logic tree, commonly called fault tree. Some new computer-oriented methods for deriving these failure modes from a system fault tree. The methods are based on a rapid procedure for decomposition of the fault tree and various subtrees. The structure of some complex systems may not be suitable for decomposition of the fault tree and various subtrees. The structure of some complex systems may not be suitable for development of a fault tree. Dissert. Abstr.

N80-27861 California Univ., Berkeley.
LOW-ENERGY PLASMA IN THE DAYSIDE AURORAL ZONE Ph.D. Thesis
Roy Banks Torbert 1979 68 p
Avail: Univ. Microfilms Order No. 8014908

Measurements of ions and electron in the energy range of 10 eV to 10 keV/Q are presented from the flights of two sounding rockets launched from Sondre Stromford, Greenland, into the dayside auroral zone at 09.00 MLT. Observations of energy versus time dispersion of precipitating ions indicate that H+ and He(++) were injected into the magnetosphere some 7 to 19 R sub E from the rocket probe. The spectra of these ions are consistent with solar wind origin. From the correlation of deviations from the expected ion dispersion curve and the onset of auroral electron precipitation, a region of parallel electric field is determined to exist within a few earth radio of the probe. Measurements of electron angular distributions support this conclusion. Implications of these measurements to the structure and dynamics of an open magnetosphere are presented in a qualitative model. Dissert. Abstr.

N80-27862 California Univ., Los Angeles.
COMPUTER SIMULATION OF A MAGNETOSPHERIC SUBSTORM Ph.D. Thesis
Moshe Harel 1980 143 p
Avail: Univ. Microfilms Order No. 8015982

Results of the first comprehensive computer simulation of the behavior of the earth's inner magnetosphere during a substorm-type event are reported. The model was tested for a substorm-type event that occurred on September 19, 1976. Satellite data (primarily from the Air Force S3-2 satellite) were used extensively both for boundary conditions and for comparisons with model predictions. Other data were also used as input for our time-dependent magnetic field and conductivity models. The S3-2 data for the event show some novel features, indspendent of the simulation. Dawn-dusk electric fields show a general correlation with the east-west magnetic field perturbations. Unexpectedly, two of the passes display substantial regions of sunward plasma flow poleward of the main part of the region-1 Birkeland currents. The cross-polar-cap potential drops

computed from the data represent the first effort at satellite monitoring of this important parameter during various phases of a substorm, and show an important enhancement during the substorm. Dissert. Abstr.

N80-27863 Purdue Univ., Lafayette, Ind.
THE KINETIC ENERGY CLIMATOLOGY OF TROPOSPHERIC AND LOWER STRATOSPHERIC FLOW REGIMES ASSOCIATED WITH 500 MB INTERMEDIATE AND SHORT WAVES OVER NORTH AMERICA Ph.D. Thesis
Yi-Tsuei Sheu 1979 113 p
Avail: Univ. Microfilms Order No. 8015517

A diagnostic analysis of total, vertical mean and vertical shear kinetic energy budgets for mid latitude 500 mb synoptic scale waves in the winter-spring season is presented. The data used were standard twice daily rawinsonde observations in 50 mb increments from surface to 100 mb over Southern Canada and the United States for December 1967, 1969 and March, April, 1970. Several conclusions can be drawn from the results of this study. (1) The generation and dissipation of kinetic energy balance each other in the boundary layer. (2) Although not balanced, a significant negative correspondence between the generation and the horizontal transport exists in the free atmosphere. Positive generation and horizontal flux divergence are observed in moist waves. (3) Both barotropic and baroclinic processes provide a source of kinetic energy to wave systems. Most of the baroclinic source is contributed in the boundary layer, although baroclinic processes extract energy from the waves in the free atmosphere. (4) Kinetic energy dissipation occurs primarily in the barotropic component of the flow. Baroclinic flow supplies energy from subgrid scale motions to the waves. (5) The energy is converted from the vertical shear to mean regimes. This vertical shear to mean kinetic energy conversion reveals that the atmosphere tends toward a more barotropic state at the expense of the baroclinic energy. Dissert. Abstr.

N80-27864 Cornell Univ., Ithaca, N. Y.
NUMERICAL SIMULATION AND THEORY OF STRONG IONOSPHERIC GRADIENT-DRIFT TURBULENCE Ph.D. Thesis
Michael John Keskinen 1978 286 p
Avail: Univ. Microfilms Order No. 8015763

Numerical and analytical studies are made of the nonlinear development of the gradient-drift or E x B instability using the mathematical model that describes the Type 2 irregularities in the E region equatorial electrojet. Using a two dimensional electrostatic fluid code with parameters typical of the daytime electrojet, the temporal and spatial power spectra are computed over a much larger range of wavelengths (9 to 128 m) than is presently studied with radar. The mean frequencies obtained agree well with linear theory except at short wavelengths while the linewidths are greater by up to an order of magnitude than the linear damping rates. For the linearly damped modes at a particular wavelength the linewidths increase with increasing electron drift velocity contrary to linear theory while at a fixed drift velocity the linewidths increase with decreasing wavelength. For three drift velocities the time averaged spatial power spectra are found to be essentially isotropic. Analytically, the direct interaction approximation of Kraichnan as modified by Kadomtsev is employed to develop a strong turbulence theory which predicts both a nonlinear wave damping, a power law for the two dimensional spectrum. Dissert. Abstr.

N80-27865 Pittsburgh Univ., Pa.
ROCKET BORNE COMPOSITION MEASUREMENTS OF THE LOWER THERMOSPHERE WITH A NEW TYPE OF INSTRUMENTATION: AURORAL SECONDARY ELECTRON ENERGY SPECTRA MEASURED WITH A NEW FORM OF CYLINDRICAL ANALYZER Ph.D. Thesis
Peter Wayne Erdman 1979 136 p
Avail: Univ. Microfilms Order No. 8015299

In an effort to improve measurements in several problem areas of atmospheric physics, two new instruments were developed for use onboard sounding rockets. Each provides significantly improved capabilities over devices previously available to researchers, and they make possible measurements which would otherwise be impractical or less precise. Both of these instruments have a multitude of laboratory as well as geophysical applications and are potentially of interest to workers in other fields. The first, which has been named the 'Optical Composition Spectrometer' (OCS), takes advantage of the characteristic emission spectra of an atom or molecule produced by electron impact in order to measure the absolute number density of that species. The second instrument is a new form of cylindrical, charged particle energy analyzer. This device features high energy dispersion, differential output, simple mechanical and electrical design, and high 'etendue'. Dissert. Abstr.

N80-27866*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HIGH RESOLUTION INFRARED SPECTROSCOPY TECHNIQUES FOR UPPER ATMOSPHERIC MEASUREMENTS
David G. Murcray, ed. (Denver, Univ.) and Jose M. Alvarez, ed. May 1980 109 p refs Workshop held in Silverthorne Colo., 31 Jul. - 2 Aug. 1979
(NASA-CP-2134; L-13780) Avail: NTIS HC A06/MF A01 CSCL 04A

Infrared heterodyne techniques were considered primarily for detecting molecules predicted to be present but not yet detected in the upper atmosphere. For individual titles, see N80-27867 through N80-27870.

N80-27867*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXECUTIVE SUMMARY OF THE WORKSHOP ON HIGH RESOLUTION INFRARED SPECTROSCOPY TECHNIQUES FOR UPPER ATMOSPHERIC MEASUREMENTS
In its High Resolution Infrared Spectry. Tech. for Upper Atmospheric Meas. May 1980 p 1-32 refs (For primary document see N80-27866 18-46)
Avail: NTIS HC A06/MF A01 CSCL 04A

The role of high resolution techniques in measurements of trace gases in the stratosphere was assessed. The capabilities of proposed infrared instruments for measurements of stratospheric trace constituents were reviewed with particular emphasis on laser heterodyne techniques. R.C.T.

N80-27868*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE INFLUENCE OF NO AND ClO VARIATIONS AT TWILIGHT ON THE INTERPRETATION OF SOLAR OCCULTATION MEASUREMENTS
Robert Boughner, Jack C. Larsen (Systems and Appl. Sci. Corp., Hampton, Va.), and Murali Natarajan *In its* High Resolution Infrared Spectry. Tech. for Upper Atmospheric Meas. May 1980 p 39-53 refs (For primary document see N80-27866 18-46)
Avail: NTIS HC A06/MF A01 CSCL 04A

The influence of short lived photochemically produced species on solar occultation measurements of ClO and NO was examined. Time varying altitude profiles of ClO and NO were calculated with a time dependent photochemical model to simulate the distribution of these species during a solar occultation measurement. These distributions were subsequently used to calculate simulated radiances for various tangent paths from which mixing ratios were inferred with a conventional technique that assumes spherical symmetry. These results show that neglecting the variation of ClO in the retrieval process produces less than a 10 percent error between the true and inverted profile for both sunrise and sunset above 18 km. For NO, errors are less than 10 percent for tangent altitudes above about 35 km for sunrise and sunset; at lower altitudes, the error increases, approaching 100 percent at altitudes near 25 km. the results also show that average inhomogeneity factors, which measure the concentration variation along the tangent path and which can be calculated from a photochemical model, can indicate which species require more careful data analysis. R.C.T.

N80-27869*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN EXPERIMENT CONCEPT TO MEASURE STRATOSPHERIC TRACE CONSTITUENTS BY LASER HETERODYNE SPECTROSCOPY
Frank Allario, James M. Hoell, Steven J. Katzberg, and Jack C. Larsen (Systems and Appl. Sci. Corp., Hampton, Va.) *In its* High Resolution Infrared Spectry. Tech. for Upper Atmospheric Meas. May 1980 p 55-79 refs (For primary document see

N80-27866 18-46)
Avail: NTIS HC A06/MF A01 CSCL 04A

Laser heterodyne spectroscopy (LHS) techniques were used to measure radical gases from Spacelab. Major emphasis was placed on the measurement of ClO, ClOnO2, HO2, H2O2, N2O5, and HOCl in solar occultation with vertical resolution less than or equal to 2-km and vertical range from 10 to 70-km. Sensitivity analyses were performed on ClO and O3 to determine design criteria for the LHS instrument. Results indicate that O3 and ClO vertical profiles can be measured with an accuracy more than or equal to 95% and more than or equal to 80%, respectively, over the total profile. R.C.T

N80-27870*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
REVIEW OF SPECTROSCOPIC DATA FOR MEASUREMENT OF STRATOSPHERIC SPECIES
Aaron Goldman, ed. (Denver Univ.) and James Hoell, ed. *In its* High Resolution Infrared Spectry. Tech. for Upper Atmospheric Meas. May 1980 p 81-112 (For primary document see N80-27866 18-46)
Avail: NTIS HC A06/MF A01 CSCL 04A

The role of various infrared techniques in measurements of trace gases in the stratosphere were surveyed. Particular emphasis was placed on the role of instruments exhibiting ultrahigh resolution (i.e., less than or equal to 0.00/cm) such as laser heterodyne spectrometers. R.C.T.

N80-27871*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPLICATIONS OF SATELLITE DATA RELAY TO PROBLEMS OF FIELD SEISMOLOGY
W. J. Webster, Jr., W. H. Miller, R. Whitley, R. J. Allenby, and R. T. Dennison (Computer Sciences Technicolor Assoc., Seabrook, Md.) Apr. 1980 112 p refs Submitted for publication
(NASA-TM-80673) Avail: NTIS HC A06/MF A01 CSCL 08K

A seismic signal processor was developed and tested for use with the NOAA-GOES satellite data collection system. Performance tests on recorded, as well as real time, short period signals indicate that the event recognition technique used is nearly perfect in its rejection of cultural signals and that data can be acquired in many swarm situations with the use of solid state buffer memories. Detailed circuit diagrams are provided. The design of a complete field data collection platform is discussed and the employment of data collection platforms in seismic network is reviewed. Author

N80-27872*# Ohio State Univ., Columbus. Dept. of Geodetic Science.
REDUCING THE ERROR OF GEOID UNDULATION COMPUTATIONS BY MODIFYING STOKES' FUNCTION
Christopher Jekeli May 1980 55 p refs
(Grant NGR-36-008-161)
(NASA-CR-163316; Rept-301) Avail: NTIS HC A04/MF A01 CSCL 08E

The truncation theory as it pertains to the calculation of geoid undulations based on Stokes' integral, but from limited gravity data, is reexamined. Specifically, the improved procedures of Molodenskii et al. are shown through numerical investigations to yield substantially smaller errors than the conventional method that is often applied in practice. In this improved method, as well as in a simpler alternative to the conventional approach, the Stokes' kernel is suitably modified in order to accelerate the rate of convergence of the error series. These modified methods, however, effect a reduction in the error only if a set of low-degree potential harmonic coefficients is utilized in the computation. Consider, for example, the situation in which gravity anomalies are given in a cap of radius 10 deg and the GEM 9 (20,20) potential field is used. Then, typically, the error in the computed undulation (aside from the spherical approximation and errors in the gravity anomaly data) according to the conventional truncation theory is 1.09 m; with Meissl's modification it reduces to 0.41 m, while Molodenskii's improved method gives 0.45 m. A further alteration of Molodenskii's method is developed and yields an RMS error of 0.33 m. These values reflect the effect of the truncation, as well as the errors in the GEM 9 harmonic coefficients. The considerable improvement, suggested by these results, of the modified methods over the conventional procedure is verified with actual gravity anomaly data in two oceanic regions, where the GEOS-3 altimeter geoid serves as the basis for comparison. The optimal method of truncation, investigated by Colombo, is extremely ill-conditioned. It is shown that with no corresponding regularization, this procedure is inapplicable. Author

N80-27873*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Dept. of Space.
ASSESSMENT OF ATMOSPHERIC HEIGHT UNCERTAINTIES FOR HIGH PRECISION SATELLITE ALTIMETER MISSIONS TO MONITOR OCEAN CURRENTS
Julius Goldhirsh and John R. Rowland Jun. 1980 73 p refs (Contract NASA Order P-78192; Contract N00024-78-C-5384)
(NASA-CR-156868; JHU/APL-SIR80U-018) Avail: NTIS HC A04/MF A01 CSCL 04A

The influence of the atmosphere on nadir directed signal associated with satellite altimeters are examined. Frequencies at 6, 13.5, and 35 GHz are selected so as to provide a parameter study. Uncertainties are summarized in both existing and proposed techniques which establish ionospheric and tropospheric height corrections. The error summary thus gives values describing the best you can do in height resolution (as dictated by atmospheric parameters) for a satellite borne altimeter system. The results presented reflect data gleaned from the literature, at large, as well as from the existing body of published literature associated with the Seasat A Altimeter Experiment. Specifically considered are: (1) the effects of precipitation on altimeter signals, (2) range errors due to refractive index variations in both the clear atmosphere (convective and nonconvective) and clouds, and (3) range errors introduced by the ionosphere. A preliminary analysis is pursued establishing the feasibility of incorporating rain rate range gates in a future satellite-borne altimeter system. F.O.S.

N80-27874# European Space Agency, Paris (France).
EUROPEAN EARTHQUAKE PREDICTION PROGRAM
T. D. Guyenne, ed. and G. Levy, ed. Mar. 1980 218 p refs Partly in ENGLISH and FRENCH Proceedings of Council of Europe Parliamentary Assem. and ESA Workshop on European Earthquake Prediction Program, Strasbourg, 31 Jan. - 1 Feb. 1980 Prepared jointly with Council of Europe, Strasbourg, France
(ESA-SP-156) Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

The collection of geophysical data, the identifying of earthquake precursors, and the forecasting of earthquake events are considered. Various programs and projects covering seismogeneticity, seismotectonics, and the development of data collection systems are proposed, including cost estimates. Research emphasis is on the Iberian peninsula, the Italian peninsula, the area around Greece, and the North Anatolian fault zone. Methodology is explained, while a METEOSAT data collection system and a European data center are described. For individual titles, see N80-27875 through N80-27891.

N80-27875# Instituto Geografico Nacional, Madrid (Spain).
A BRIEF SUMMARY OF A PROPOSED PROGRAM FOR EARTHQUAKE PREDICTION AND THE STUDY OF PLATE DYNAMICS IN SOUTHWEST EUROPE
A. Lopez-Arroyo *In* ESA European Earthquake Prediction Program Mar. 1980 p 19-21 (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

A program to develop and test, on a seismically active zone, observational techniques for earthquake prediction, to measure the relative displacement of the Euro-Asiatic, African, and American plates, and to investigate the influence of such plate dynamics on the seismic energy release in a given area is proposed. The earthquake prediction experiment will be carried out in a zone selected from one of the two most active regions of Spain, Andalucia and Murcia, where recent earthquakes (Granada 1884, Torrevieja 1826) resulted in considerable damage and hundreds of casualties. Data handling techniques and cost considerations are discussed. Author (ESA)

N80-27876# Instituto Geografico Nacional, Madrid (Spain).
PROPOSED PROGRAM FOR EARTHQUAKE PREDICTION

IN SOUTHERN SPAIN

A. Lopez-Arroyo *In* ESA European Earthquake Prediction Program Mar. 1980 p 23-35 refs (For primary document see N80-27874 18-46)

Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

Southern Spain, included for the most part in the Alpine chain, and located close to the contact zone of two large plates (Eurasia and Africa) is the site of a seismic activity responsible for some catastrophic earthquakes in the past. A program to develop and test in this zone different techniques of earthquake prediction is proposed. Many techniques already tried in other regions will be tested, such as the study of past and present day seismicity (variation in time and space of geometric and dynamic local parameters), the application of geodetic methods (repeated triangulations, trilaterations, and levelling), geophysical measurements relative to the Earth magnetic and gravity fields, tilt and strain recording, etc. It is hoped that the best suited techniques for earthquake prediction in each zone can be derived from the test. Data handling techniques and cost considerations are also discussed. Author (ESA)

N80-27877# Instituto Nacional de Meteorologia e Geofisica, Lisbon (Portugal).

INVESTIGATION OF PRECURSORS AROUND THE AZORES ARCHIPELAGO AND THE SEISMOGENETIC CAPACITY OF THAT AREA: MODELS OF THE EARTHQUAKE PROCESS ALONG THE BOUNDARY BETWEEN THE AFRICAN AND EURASIAN PLATES, AFFECTING THE PORTUGUESE TERRITORY

L. A. MendesVictor *In* ESA European Earthquake Prediction Program Mar. 1980 p 37-53 (For primary document see N80-27874 18-46)

Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

The behavior of the Earth's surface, mainly uplift and subsidence, were analyzed and models suggested that relate the changes in elevation to earthquakes are suggested. A program to monitor various earthquake precursors is proposed. Gravity measurements, strain measurements, tilt, magnetic field configuration, electrical resistivity, and seismic p and s wave velocities are all suggested for study. Data analysis for larger networks than the one proposed as well as comparison of results obtained for different regions are also brought up. For the moment the described project intends to study the time and space evolution of two seismic active structures and their seismogenetic capacity. Author (ESA)

N80-27878# Trieste Univ. (Italy). Ist. di Geodesia e Geofisica.

FEASIBILITY STUDY FOR THE TELETRANSMISSION OF DATA FROM GEOPHYSICAL NETWORK INSTALLED IN A SEISMIC AREA TO AN OPERATIONAL CENTER

C. Ebblin and M. Zadro *In* ESA European Earthquake Prediction Program Mar. 1980 p 57-66 refs (For primary document see N80-27874 18-46)

Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

The possibility of transmitting geophysical data, first by radio from outlying data collection platforms to a central receiving station, then by telephone to a data processing center, is studied. A tilt and strain meter network located in Italy is used as an example. The earthquake prediction activities of this network are explained in detail. The scheme of the data teletransmission system is modular and is shown to be readily adaptable to any other kind of network with similar instrumentation. Transmission equipment specifications and data compatibility requirements are given. Author (ESA)

N80-27879# Trieste Univ. (Italy). Ist. di Miniere e Geofisica Applicata.

THE FEASIBILITY STUDY FOR ABSOLUTE MEASUREMENT MONITORING OF GRAVITY FIELD VARIATIONS, CONNECTED WITH INTERNAL MASS VARIATION

C. Morelli *In* ESA European Earthquake Prediction Program Mar. 1980 p 67-71 refs (For primary document see N80-27874 18-46)

Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

Geodetic nets associated with high accuracy gravimetric networks, suitable for studying earthquake precursors are considered. A gravimetric network in Italy is described and two more for the same country are proposed. The development and improvement of the gravimeter in use is discussed. A cost estimate of the project covering the necessary field and laboratory work is included. Author (ESA)

N80-27880# Consiglio Nazionale delle Ricerche, Rome (Italy).

PROJECT FOR SEISMOGENETIC RESEARCH IN THE CALABRAIS ARC [PROJET DE RECHERCHE SUR LA SISMOGENESE DANS L'ARC CALABRIS]

In ESA European Earthquake Prediction Program Mar. 1980 p 73-83 refs In FRENCH Prepared jointly by Centre National de la Recherche Scientifique, Paris, France (For primary document see N80-27874 18-46)

Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

A project for the study of a seismically active area in Italy is proposed. Investigations are to include data acquisition on the general geological structure of the region as well as on crust and upper mantle formations. Measurement techniques involve looking at the speed of propagation and attenuation of surface waves, at aeromagnetic data, and include gravimetric and differential magnetic field readings. Financing and data handling are also covered. Author (ESA)

N80-27881# Thessaloniki Univ. (Greece).

PROPOSAL FOR AN EARTHQUAKE PREDICTION PROJECT IN NORTHERN GREECE

E. Livieratos, B. C. Papazachos, and D. Vlachos *In* ESA European Earthquake Prediction Program Mar. 1980 p 87-97 refs (For primary document see N80-27874 18-46)

Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

An earthquake prediction program proposed for the Thessaloniki area (Greece) is presented. The zone where seismic, geophysical, and geodetic measurements will be performed is analyzed seismologically. Observation infrastructures along with the availability of instrumentation and software are discussed. Data handling is also considered. Author (ESA)

N80-27882# Paris-Sud Univ., Orsay (France).

IN SITU MEASUREMENTS OF CONSTRAINTS TO BE MADE IN GREECE [MESURES DE CONTRAINTES IN SITU EN GRECE]

C. Froidevaux *In* ESA European Earthquake Prediction Program Mar. 1980 p 99-100 refs In FRENCH (For primary document see N80-27874 18-46)

Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

A project complementary to the earthquake prediction program in the Thessaloniki area is proposed. In situ measurements of neotectonic constraints are to be taken in the Aegean domain. Observation techniques include shallow drilling, the use of strain gages at the base of the shaft, and core sampling. The data to be obtained are considered as useful in explaining seismic mechanisms and in evaluating seismic risk. Author (ESA)

N80-27883# Paris-Sud Univ., Orsay (France).

CRUSTAL STRESS AND HEAT FLOW MEASUREMENT IN NORTHERN ANATOLIA

C. Froidevaux *In* ESA European Earthquake Prediction Program Mar. 1980 p 103-105 (For primary document see N80-27874 18-46)

Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

Earthquake precursor phenomena along the North Anatolian fault zone is considered in order to determine the crustal stress field associated with this major seismic zone. Only two other major intracontinental active shear zones comparable with that of North Anatolia are presently under study; the San Andreas fault system in California and the Alpine fault in New Zealand. It is suggested that the mechanical behavior of these three transcurrent faults be tested and compared. To this end it is of primary importance to determine best flow profiles and make series of in situ stress measurements. Techniques include the use of bore holes (300 m deep) for heat flow measurements and stress measurements based on hydrofracturing. Project cost considerations are also taken into account. Author (ESA)

N80-27884# Bonn Univ. (West Germany). Inst. fuer Theoretische Geodaesie.

A FIRST EUROPEAN JOINT EFFORT IN EARTHQUAKE PREDICTION RESEARCH

M. Bonatz, R. Meissner (Kiel Univ.), and J. Zschau (Kiel Univ.) *In* ESA European Earthquake Prediction Program Mar. 1980 p 107-122 refs (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

An area along the trans-Anatolian fault zone in Turkey selected for an intensive study on earthquake precursor phenomena was based on historical and statistical data of earthquake occurance. As the nucleus of a European earthquake prediction program, including future measurements from space, three kinds of ground based experiments are proposed: (1) a geodetic experiment, i.e., high precision distance and angle measurements for the determination of pre-, co-, and post-seismic strain and creep phenomena; (2) a seismic experiment for measuring velocities and absorption in two perpendicular directions; and (3) a tiltmeter experiment, measuring surface tilt related to changes in elastic and inelastic parameters. The data handling system, including satellite data relay, and experiment cost are also considered.
Author (ESA)

N80-27885# Ankara Univ. (Turkey).
EARTHQUAKE PREDICTION RESEARCH FOR THE NORTHERN ANATOLIAN FAULT ZONE (TURKEY)
A. Isikara (Istanbul Univ.), R. Ates, and A. Guerpinar *In* ESA European Earthquake Prediction Program Mar. 1980 p 123-131 (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

Various earthquake precursors observed in the Anatolian fault area are studied in order to contribute to earthquake prediction methodology. A precise knowledge of the rate of movement and strain accumulation on a time scale derived from tectonic theory is sought. Data are to be collected on microearthquakes, geodetics, tilt, seismic wave velocities, magnetic field changes, gravity field changes, and changes in ground water level. Public observations on anomalous events are also considered to be useful.
Author (ESA)

N80-27886# Imperial Coll. of Science and Technology, London (England).
AN OUTLINE PROPOSAL OF SOME AIMS, STRATEGIES AND OBJECTIVES
B. K. Atkinson *In* ESA European Earthquake Prediction Program Mar. 1980 p 135-155 refs (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

Some general comments are made concerning the overall philosophy of earthquake hazard reduction. An outline is presented of the key areas that need studying in any European earthquake prediction program. Finally, a specific project for experimental studies of the physical mechanisms of earthquake sources is proposed. Phenomena to be studied include static fatigue leading to subcritical crack growth, dynamic fatigue in the development of fault rock, fracture healing processes, acoustic emission, and post failure events. The measurement of geophysical parameters is also proposed. Funding requirements are discussed.
Author (ESA)

N80-27887# Bureau de Recherches Geologiques et Minieres, Orleans (France).
SEISMOTECTONIC EVALUATION OF EUROPE, EXCLUDING THE BALKANS [EVALUATION SISMOTECTONIQUE DE L'EUROPE EXCEPTE LES BALKANS]
In ESA European Earthquake Prediction Program Mar. 1980 p 157-159 In FRENCH (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

A project to compile macroseismic historical data as well as tectonic instrument data so as to evaluate the geophysical structure of most of Europe is proposed. The end product is a 1/25,000,000 scale map showing the seismotectonic characteristics of the European continent. Emphasis is on the correlation of data confidence.
Author (ESA)

N80-27888# European Space Agency, Paris (France). Inst. fuer Meteorologie und Geophysik.
RESEARCH ON SPECIFIC MODELS FOR THE OCCURRENCE OF SIGNIFICANT EARTHQUAKES IN EUROPE
H. Berckhemer (Inst. fuer Meteorol. u. Geophys., Frankfurt am Main, West Germany) and G. Purcaru *In* ESA European Earthquake Prediction Program Mar. 1980 p 161-176 refs (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

The existence of regularities in the occurrence of earthquake events is discussed relative to European earthquake case histories. Emphasis is on identifying a pattern as to location, magnitude, and time of occurrence data. The concepts of seismic cycle and seismic gap in prediction models are described. As an example, the Yugoslavian earthquake (April 15, 1979; seven on the Richter scale) is examined. Results show this event could have been predicted using the presented method. A project to implement the method is porposed.
Author (ESA)

N80-27889# Freie Univ., Berlin (West Germany). Inst. fuer Geophysik.
FUTURE ASPECTS OF EARTHQUAKE PREDICTION RESEARCH
A. Vogel *In* ESA European Earthquake Prediction Program Mar. 1980 p 177-179 *ref* (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

An assessment of progress made towards the understanding of earthquake generation, both through experimental and theoretical approaches, is presented. Emphasis is on defining prediction constraints based on observations of strain physical properties, and seismotectonics. Particular reference is made to work being done in the North Anatolian fault zone.Author (ESA)

N80-27890# European Space Data Centre, Darmstadt (West Germany). Meteosat Data Management Dept.
THE METEOSAT DATA COLLECTION SYSTEM AND ITS POTENTIAL AS A DATA RELAY FOR GEOPHYSICAL MEASUREMENTS
R. Robson and H. Houet *In* ESA European Earthquake Prediction Program Mar. 1980 p 183-188 (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

The Meteosat data collection and relay system is described. How this data system can be incorporated into a ground based data collection program is explained. Emphasis is on the relaying of geophysical data from observation sites spread out over a wide area to a central processing center. Application to earthquake prediction programs is suggested.
Author (ESA)

N80-27891# Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. of Geophysics.
THE EUROPEAN-MEDITERRANEAN SEISMOLOGICAL CENTRE (EMSC)
S. Mueller *In* ESA European Earthquake Prediction Program Mar. 1980 p 189-193 refs (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

The European-Mediterranean Seismological Center and its activities are described. The objectives of this data processing center are (1) to initiate a system for the rapid determination of European and Mediterranean epicenters and to transmit the results as needed, (2) to gather all seismological data necessary for the functioning of the center in a unified format directly amenable to calculation in order to promote processing, and (3) to exchange data with other data centers.
Author (ESA)

N80-27892# Preussag A.G., Erdoel und Erdgas, Hannover (West Germany).
INVESTIGATION OF WAVE FREQUENCY AT DIFFERENT TRAVEL TIMES Final Report
Guenther Babbel, Ludwig Engelhard, and Carsten Schimanowski Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 42 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-77) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 8,85

Changes of frequency spectra due to travel time and interbedded layers investigated using seismic field recordings, synthetic models, and model-seismic records (three layer model) are considered. Results of investigations to determine the absorption of seismic waves are presented. For individual titles, see N80-27893 through N80-27895.

N80-27893# Preussag A.G., Erdoel und Erdgas, Hannover (West Germany).
INVESTIGATION OF AMPLITUDE AND FREQUENCY IN SEISMIC REFLECTIONS: STUDY OF THE ABSORPTION OF REFLECTED SEISMIC STUDIES Final Report [AMPLITUDEN- UND FREQUENZUNTERSUCHUNGEN IN DER REFLEXIONSSEISMIK. ABSORPTIONSUNTERSUCHUNGEN AN REFLEXIONSSEISMISCHEN SIGNALEN]
G. Babbel (Technische Univ., Clausthal, West Germany) *In its* Invest. of Wave Freq. at Different Travel Times Dec. 1979 p 8-16 In GERMAN (For primary document see N80-27892 18-46)
Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 8,85

A method of amplitude spectra division is presented to determine the absorption coefficient of a reflected seismic wave as a linear function of the frequency, while the Q factor becomes constant. It is demonstrated that classical methods for determination of absorption using real data cannot solve these problems. Theoretical consideration should give good results of the Q factor in case of va wavelets not superimposed by multiple events.
Author (ESA)

N80-27894# Preussag A.G., Erdoel und Erdgas, Hannover (West Germany).
EXPERIMENTS IN THE DETERMINATION OF SEISMIC WAVE ABSORPTION Final Report [ERFAHRUNGEN BEI DER BESTIMMUNG DER ABSORPTION SEISMISCHER WELLEN]
L. Engelhard (Technishce Univ., Brunswick) *In its* Invest. of Wave Freq. at Different Travel Times Dec. 1979 p 17-27 In GERMAN (For primary document see N80-27892 18-46)
Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 8,85

Methods to test and refine investigative findings on the mechanism of seismic reflection are studied. Results lead to the development of an algorithm by which the absorption coefficient (defined as the proportional inverse of the Q factor) can be determined as a supplementary lithological parameter of seismogram readings.
Author (ESA)

N80-27895# Preussag A.G., Erdoel und Erdgas, Hannover (West Germany).
INVESTIGATION OF A SEISMIC MODEL USING A THREE LAYER MODEL Final Report [MODELLSEISMISCHE UNTERSUCHUNGEN AN DREI-SCHICHT-MODELLEN]
C. Schimanowski (Technische Univ., Berlin) *In its* Invest. of Wave Freq. at Different Travel Times Dec. 1979 p 28-37 In GERMAN (For primary document see N80-27892 18-46)
Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, Germany DM 8,85

The propagation of P and S waves through a laboratory test medium was studied. The medium consisted of an aluminum base to which was fixed a layer of PVC, then a layer of plexiglass, and finally a layer of Makrolon (three layer model). Horizontal and vertical velocity components as well as power spectra were measured and compared to known wave travel times for the various layers. A PDP 11/40 computer was used in the analysis.
Author (ESA)

N80-27896# Washington Univ., Seattle. Dept. of Electrical Engineering.
MULTIPLE SCATTERING EFFECTS ON TRANSMISSION THROUGH THE ATMOSPHERE Annual Summary Report, 1 Sep. 1979 - 31 Aug. 1980
Akira Ishimaru Apr. 1980 7 p refs
(Contract N00014-78-C-0723)
(AD-A083615; ONR-TR-2) Avail: NTIS HC A02/MF A01 CSCL 04/1

The work is directed to the investigation of the transmission characteristics of optical waves with wavelengths in the range of 1-15 micrometers through various atmospheric conditions including clouds, fog, turbulence, rain, hail, snow, and inhomogeneous layers. Progress was made in the areas of plane wave solution, beam wave solution, and pulse wave solution of

N80-27897# Utah State Univ., Logan. Space Measurements Lab.
DEVELOPMENT OF A SMALL ROCKET SYSTEM FOR CONDUCTIVITY MEASUREMENTS IN THE HIGH LATITUDE DISTURBED D-REGION IN SUPPORT OF ELF/VLF PROPAGATION STUDIES Final Report, 9 Oct. 1978 - 20 Jun. 1979
D. A. Burt, E. F. Pound, and G. D. Allred 30 Jun. 1979 27 p refs
(Contract DNA001-78-C-0342)
(AD-A083331; AD-E300715; DNA-5039F) Avail: NTIS HC A03/MF A01 CSCL 20/14

An ultra-miniature conductivity probe for small rocket applications has been developed for measurements within the lower atmosphere (D-region and below). The probe is contained within a MET rocket and may be launched from standard MET sites with a minimum of personnel and equipment. The measuring instrument is a miniature Gerdien condenser, which is ejected near apogee and is trailed by a starute to reduce descent speeds below sonic values. Accumulated data are transmitted via telemetry ,to a recording ground station. The initial application of this instrument was at the White Sands Small Missile Range on 14 December 1978. After payload ejection near apogee data were recorded for over an hour as the instrument descended on the starute. Some modifications are indicated, but basically the concept and experiment appear sound.
GRA

N80-27898# Air Force Geophysics Lab., Hanscom AFB, Mass.
A DISCUSSION OF ARCTIC IONOGRAMS Interim Report
R. A. Wagner and C. P. Pike 14 Apr. 1980 24 p refs Presented at AGARD Tech. Meeting, Lindau/Harz, West Germany, Sep. 1971
(AD-A083550; AFGL-TR-80-0120) Avail: NTIS HC A02/MF A01 CSCL 04/1

Example of arctic ionogram sequences, recorded on the AFCRL Flying Ionospheric Laboratory, are presented. The purpose of this paper is to show that: (a) ionogram sequences, recorded on arctic flights, facilitate the interpretation of oblique incidence echoes from E- and F-layer heights, (b) parameters of the arctic ionosphere can be mapped by using the 'auroral oval' as an ordering system, (c) vertical and oblique incidence echoes, appearing on ground station ionograms, can be interpreted in terms of the station's position relative to the auroral oval. The analysis of a three hour flight with 6 latitudinal scans underneath an aurcral band shows the close relationship between auroral sporadic E echoes (Esa) and discrete aurora. The investigation of 49 latitudinal scans through the auroral oval during times of low magnetic activity revealed the existence of a particle produced E layer which is oval aligned, is 2 deg to 6 deg wide in corrected geomagnetic latitude and occurs at all corrected geomagnetic times. This layer produces the night E echoes. A new ionogram analysis procedure, which uses oblique incidence F-layer echoes, is demonstrated, and the feasibility of monitoring the latitude of the southern edge of the polar F-layer irregularity zone by using this new analysis procedure is demonstrated.
GRA

N80-27899# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
A METHOD FOR DIRECT DETERMINATION OF REAL HEIGHT FROM VIRTUAL HEIGHT DATA FOR THE AURORAL REGION OF THE IONOSPHERE Environmental Research Papers. Interim Report
Milton M. Klein 14 Nov. 1979 21 p refs
(AF Proj. 4643)
(AD-A083139; AFGL-TR-79-0276; AFGL-ERP-684) Avail: NTIS HC A02/MF A01 CSCL 04/1

As part of an effort to determine electron density profiles in the auroral region of the ionosphere, a method has been developed for directly calculating real height from virtual height data obtained at high latitudes. The essential ingredient of the method is the representation of the curved portion of the ordinary ray dispersion curve by an analytic form which reduces the virtual height - real height integral relation to a form of Abel's integral equation. Numerical checks indicate that the present method gives an accurate representation of the dispersion curve. The correctness of the present procedure has been verified for the case of a linear electron density profile. The present method will be applied

in the auroral region from virtual height data. The accuracy and convenience of the present method will be assessed by comparison of the results with those obtained from standard programs. GRA

N80-27900# Air Force Geophysics Lab., Hanscom AFB, Mass.
MARINE BOUNDARY LAYER SAMPLING, FLIGHT NO. 2 Environmental Research Papers. Interim Report
Ian D. Cohen 11 Oct. 1979 73 p refs
(AF Proj. 317J)
(AD-A083158; AFGL-TR-79-0242; AFGL-ERP-678) Avail: NTIS HC A04/MF A01 CSCL 04/2

On 22 March 1979, an instrumented MC-130E for cloud physics measurements by AFGL made a series of 8 min sampling passes at altitudes ranging from 100 to 1000 ft above the ocean surface off the coast of Washington. The flight profile was similar to that flown by the same aircraft on 10 July 1978 off the coast of California (AFGL-TR-79-0013). Winds were light, and the visibility generally was 7 miles or greater. Varying numbers of particles were detected in the 2 to 22 micrometer range at all levels. The number of particules was fairly constant with altitude; liquid water content (LWC) was about 0.001 g/cu m at all levels. This was in contrast to the 10 July 1978 flight, where LWC varied much more, both with height and location. The differences between the two flights are attributed to the lower windspeeds and the resultant fewer whitecaps observed on this second flight. GRA

N80-27901# Rome Air Development Center, Griffiss AFB, N.Y.
ULF/LF REFLECTIVITY OF THE POLAR IONOSPHERE Technical Report, 31 Dec. - 5 May 1979
Robert P. Pagliarulo, John P. Tuttle, John E. Rasmussen, Robert L. Coley, and Wayne I. Klemetti (Megapulse, Inc.) Oct. 1979 86 p refs
(AF Proj. 4600)
(AD-A083240; RADC-TR-79-273) Avail: NTIS HC A05/MF A01 CSCL 20/14

This report provides a summary of high latitude ionospheric reflectivity as observed by the USAF high resolution VLF/LF ionosounder operating in northern Greenland. Ionospheric reflectivity parameters, including reflection heights and coefficients, are presented as a function of time of day. VLF long path propagation measurements, along with magnetometer and riometer data, are presented as supplementary data. GRA

N80-27902# SRI International Corp., Menlo Park, Calif.
EFFECTS OF IMPULSIVE HEATING EVENTS ON F-REGION CHEMISTRY AND ELECTRON DENSITY Topical Report, Mar. 1978 - Jul. 1979
John D. Kelly 31 Jul. 1979 41 p refs
(Contract DNA001-77-C-0042)
(AD-A083333; AD-E300727; NDA-5028T; HAES-Rept-81) Avail: NTIS HC A03/MF A01 CSCL 04/1

The Chatanika incoherent rada was used to study the ionospheric effects of impulsive auroral heating events. In some cases, the time integrated auroral energy deposition is similar in magnitude to that expected from a high altitude nuclear event outside the fireball region. The resulting ionospheric effects are significant. The elevated temperatures and atmospheric heave contribute to s substantial change in F region ion chemistry, changing the domainant F region ion from atomic to molecular species. As a result, a significant depletion of the F region electron density occurs. Currently these effects are not accurately predicted by the nuclear codes, as the function of the codes is to predict the large-scale perturbations. The Chatanika radar data can be used to improve the ambient ionospheric models and to improve the predictions of F region changes resulting from sudden heating events. Author

N80-27903# Naval Research Lab., Washington, D. C. Geophysical Plasma Dynamics Branch.
NONLINEAR EQUATORIAL SPREAD F: SPATIALLY LARGE BUBBLES RESULTING FROM LARGE HORIZONTAL SCALE INITIAL PERTURBATIONS
S. T. Zalesak and S. L. Ossakow 6 Feb. 1980 44 p refs
Sponsored in part by DNA, Washington, D.C.
(AD-A083393; AD-E000391; NRL-MR-4154) Avail: NTIS HC A03/MF A01 CSCL 04/1

Motivated by the observations of large horizontal scale length equatorial spread F 'bubbles', we have performed numerical simulations of the nonlinear evolution of the collisional Rayleigh-Taylor instability in the nighttime equatorial ionosphere, using large horizontal scale length initial perturbations. The calculations were performed using a new, improved numerical code which utilizes the recently developed, fully multidimensional flux corrected transport (FCT) techniques. We find that large horizontal scale initial perturbations evolve nonlinearly into equally large horizontal scale spread F bubbles, on a time scale as fast as that of the corresponding small horizontal scale length perturbations previously used. Further, we find the level of plasma depletion inside the large scale bubbles to be appreciably higher than that of the smaller scale bubbles, approaching 100%, in substantial agreement with the observations. This level of depletion is due to the fact that the plasma comprising the large scale bubbles has its origin at much lower altitudes than that comprising the smaller scale bubbles. Analysis of the polarization electric fields produced by the vertically aligned ionospheric irregularities show this effect to be due to fringe fields similar in structure to those produced at the edge of a parallel plate capacitor. GRA

N80-27904# Technology Service Corp., Santa Fe, N. Mex.
EMPIRICAL STUDIES OF THE RELATIONSHIPS BETWEEN EMISSIONS AND VISIBILITY IN THE SOUTHWEST Interim Report, May 1978 - Mar. 1979
Marilyn Marians and John Trijonis Sep. 1979 118 p refs
(Grant EPA-802815)
(PB80-156136; EPA-450/5-79-009) Avail: NTIS HC A06/MF A01 CSCL 04A

Historical emission trends of SOx, NOx, and NMHC are determined year-by-year from 1948 to 1975 for four Southwestern states (Arizona, Colorado, Nevada, and Utah). Trends in visibility levels (medians and other percentiles) are documented for the period 1948-1976 at 12 airports in the Southwest. Two analyses are used to relate emission changes to variations in regional extinction levels. The first analysis examines the air quality changes associated with a 90 percent reduction of Southwestern SOx emissions during a nine month copper strike and estimates the extinction produced by SOx emissions on various spatial scales. The second analysis involves regression studies relating historical extinction levels from 1948-1975. Because of limitations in the analytical methods, there is a high degree of uncertainty in many of the results. However, the studies do provide insights into the effects of aerosol precursor emissions on extinction at various distances from sources. In the case of mesoscale effects of SOx in the Southwest, quantitative coefficients are proposed which link emissions to regional extinction. GRA

N80-27905# National Oceanic and Atmospheric Administration, Boulder, Colo.
THE NOAA SEL HF RADAR SYSTEM (IONOSPHERIC SOUNDER)
R. N. Grubb Oct. 1979 22 p refs
(PB80-160989; NOAA-TM-ERL-SEL-55; NOAA-80012206) Avail: NTIS HC A02/MF A01 CSCL 04A

The Space Environment Laboratory of the National Oceanic and Atmospheric Administration has developed a new general purpose computer based system for pulsed RF measurements of the ionosphere in the 100 kHz - 30 MHz frequency range. This is a development of the earlier Dynasonde concept to permit full digital signal processing of returned echoes, a dual channel receiver to enable faster measurements of wave polarization and direction of arrival, and a considerably enhanced data process and display capability. The system philosophy adopted is discussed and some details of the implementation and performance of the instrument are given. A number of instruments are now being produced for various institutions which will form the basis of a coordinated research program over the next ten years. GRA

N80-27906# California Univ., Los Angeles. Earthquake Lab.
CORRELATIONS OF SEISMIC VELOCITY WITH DEPTH IN SOUTHERN CALIFORNIA
Kenneth W. Campbell, Robert Chieruzzi, C. Martin Duke, and Marshall Leu Oct. 1979 52 p refs
(Grants NSF GI-44056; NSF ATA-73-0323)
(PB80-164080; UCLA-ENG-7965; NSF/RA-790386) Avail: NTIS HC A04/MF A01 CSCL 08K

Updated correlations relating seismic velocity and Poisson's

ratio with depth and various geotechnical parameters for different soil and rock classifications found in Southern California are presented. Prior data are incorporated with 48 new velocity measurements. Shear-wave and compressed wave velocity is presented together with supporting geotechnical data. Statistics are compared for each classification for surface and near surface waves and for Poisson's ratios. Correlations to depth are presented for a few of the classifications for which sufficient data are available. The geotechnical parameters significant to seismic velocity and Poisson's ratio include geologic age, gravel content, water table depth, dry density, and depth of overburden. GRA

N80-27907# National Oceanic and Atmospheric Administration, Boulder, Colo. World Data Center A for Solid Earth Geophysics.
GEOMAGNETIC OBSERVATIONS 1978
C. Sucksdorff, H. Nevanlinna, and K. L. Svendsen Nov. 1979 95 p refs Prepared in cooperation with Finnish Meteorological Inst., Helsinki
(PB80-146087; SE-21) Avail: NTIS HC A05/MF A01 CSCL 04A

Two hundred nine of the known geomagnetic observatories throughout the world are described. Based on response to a questionnaire distributed by the Working Group on Magnetic Observatories for the International Association of Geomagnetism and Aeronomy (IAGA), information on data reporting and exchange, recording instruments and methods of baseline control was obtained. The observatories are listed according to name, latitude and country. The questionnaire and IAGA resolutions concerning magnetic observatories adopted since 1963 are included. GRA

N80-27908# Colorado State Univ., Fort Collins. Dept. of Earth Resources.
APPLICATION OF GEOMORPHIC PRINCIPLES TO ENVIRONMENTAL MANAGEMENT IN SEMIARID REGIONS
S. A. Schumm, M. T. Bradley, and Z. B. Begin Colorado Water Resources Inst. Feb. 1980 57 p refs
(Contract DI-14-34-0001-7143)
(PB80-169303; COMPLETION-93; W80-04443; OWRT-B-150-COLO(2)) Avail: NTIS HC A04/MF A01 CSCL 08M

In many valleys of the semiarid West valley floors are either flat and vegetated without a channel, or they are gullied. Using previously collected data from the Piceance Creek area of western Colorado, it is possible to identify a valley-slope threshold above which, for a given drainage area, gullying is probable. Below this valley-slope threshold, the valley floors are stable; above it they are susciptable to gullying. When the relations and techniques developed in western Colorado were applied to the Chalk Bluffs area of northeastern Colorado, it was determined that valley width was also a significant factor determining valley stability, and a ratio of valley slope to valley width could be used to identify at a given drainage area a threshold zone of velley floor instability. GRA

N80-27735# Cologne Univ. (West Germany). Inst. for Geophysics and Meteorology.
RADIATION BALANCE AND RADIATION PROCESSES Final Report
E. Raschke *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 19-27 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27736# Kiel Univ. (West Germany). Inst. for Marine Research.
THE EARTH'S HYDROSPHERE AND CRYOSPHERE Final Report
W. Krauss *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 28-34 (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27737# British Meteorological Office, Bracknell (England).
ATMOSPHERIC STRUCTURE AND COMPOSITION Final Report
K. Stewart *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 35-38 (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27740# European Centre for Medium-Range Weather Forecasts, Reading (England).
ATMOSPHERIC MODELS
A. Wiin-Nielsen *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 51-62 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27741# Max-Planck-Institut fuer Meteorologie, Hamburg (West Germany).
STOCHASTIC PROCESSES IN THE ATMOSPHERE-OCEAN SYSTEM
K. Herterich *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 63-65 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27743# Universite des Sciences et Techniques de Lille (France). Lab. d'Optique Atmospherique.
RADIATIVE TRANSFER IN THE CLOUDY AND DUSTY ATMOSPHERE
J. Lenoble *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 75-81 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27744# Innsbruck Univ. (Austria). Inst. fuer Meteorologie und Geophysik.
ENERGY TRANSPORT IN THE EARTH-ATMOSPHERE SYSTEM AND THE RADIATION BALANCE
H.-J. Bolle and P. Speth (Cologne Univ.) *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 83-89 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27748# Institut Royal Meteorologique de Belgique, Brussels.
SAMPLING PROBLEMS AND RADIATION BUDGETS: DATA REQUIREMENTS [PROBLEMES D'ECHANTILLONAGE ET BILANS RADIATIFS: LEUR PROBLEMATIQUE]
D. Crommelynck *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 95-102 refs In FRENCH; ENGLISH summary (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27749# Appleton Lab., Slough (England).
SATELLITE MEASUREMENTS OF ATMOSPHERIC TEMPERATURE
J. T. Houghton *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 123-127 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27750# Freie Univ., Berlin (West Germany).
THE INTERANNUAL VARIABILITY OF THE STRATOSPHERE
K. Labitzke *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 129-133 (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27751# National Physical Lab., Teddington (England).
COMPOSITION OF THE MIDDLE ATMOSPHERE: STATUS AND PRIORITIES
J. E. Harries *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 135-142 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27752# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
OZONE MONITORING FROM SPACE

A. Ghazi *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 143-151 refs
(For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27753# Technische Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
WATER VAPOR IN THE UPPER TROPOSPHERE AND IN THE STRATOSPHERE
H. Fischer *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 153-159 refs
(For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-27909 Miami Univ., Fla.
RESPONSE TO SUBTROPICAL MARINE BOUNDARY-LAYER CLOUDINESS TO LARGE-SCALE FORCING Ph.D. Thesis
Howard Paul Hanson 1979 161 p
Avail: Univ. Microfilms Order No. 8014169

Clouds in the undisturbed trades are modeled with focus on the similarities and differences between the stratocumulus regime and the trade cumulus regime. Vertical mixing processes are separated into small scale quasi isotropic turbulence and large scale convective updrafts and compensating subsidence between the clouds. As a lowest order approach cloud area, lateral cloud entrainment and detrainment by evaporating clouds are taken to be constant with height. The budgets of heat and water are solved to obtain thermodynamic profiles in the boundary layer Cloud base is found as the lifting condensation level for near surface parcels and cloud top height is found by a simple closure on the small scale turbulence. The cloud base convective updraft velocity is found from a circulation integral of the vertical equation of motion. Results show that cloud area decreases with increasing surface temperature and decreasing large scale divergence. If the surface temperature is large enough or the large scale divergence low enough, the model breaks down corresponding qualitively to the onset of deep convection. Associated with decreases of cloud area is the result that the vertical mixing processes take on larger scales, i.e., the contribution of overall mixing by the convective updrafts increase relative to the small scale turbulence. Dissert. Abstr.

N80-27910 Florida State Univ., Tallahassee.
NUMERICAL SIMULATION OF HURRICANES USING RADAR AND SATELLITE-DERIVED RAINFALL Ph.D. Thesis
John Ernest Molinari 1979 141 p
Avail: Univ. Microfilms Order No. 8014139

Rainfall rates determined from airborne radar data and infrared satellite images are used to specify the heating rate in a three dimensional primitive equation simulation of Hurricane Anita (1977) on a 0.1 degree latitude-longitude mesh. Initial winds from all available sources are analyzed at several levels and initial pressure and temperature are computed via the reverse balance equation and hydrostatic equation. A dynamic initialization procedure is developed for hurricane models by specifying the time dependent heating during a twelve hour pre-forecast integration, after which the heating is computed internally by the model. The specified heating forces the initial wind and mass fields toward a realistic initial state, and produces improved 12 and 24 hour forecasts of both position and intensity compared to a control integration, for which the heating was computed internally by the entire period. Calculations indicate that a significant term in the momentum balance is the inward flux of momentum by azimuthal eddies at 200 mb. This large contribution is produced both by eddies associated with asymmetries in the rainfall pattern and interactions with the storm environment. Dissert. Abstr.

N80-27911 State Univ. of New York at Albany.
PRELIMINARY INVESTIGATIONS OF THE ELECTRICAL RESPONSE OF WATER SURFACES DURING MARINE THUNDERSTORMS Ph.D. Thesis
Ray Brewer Toland 1979 99 p
Avail: Univ. Microfilms Order No. 8014036

Laboratory and field experiments were devised and carried out to evaluate some of the effects of intense electric fields on water surfaces during marine thunderstorms. The field experiments included employment of: (1) corona-detection antennas on floats for measuring maximum potential gradients over water; (2) Faraday cages to determine space charge density near shorelines; and (3) long, thin, horizontal wires for measuring corona current and estimating potential gradients near shorelines. Laboratory experiments included use of physical models of Worthington jets and gentle waves for determining effective field intensification due to waves, and a laboratory simulator that produced intense bubbling and splashing in known electric fields for measuring electric current densities due to corona and levitated water drops. An explanation of each apparatus and a theory of its operation are given. Results from the field experiments indicate that during thunderstorms over water, surface electric fields often attain maximum values of 30 to 50 kV/m. Two values greater than 100 kV/m have been measured, and there is some evidence that short peak values of even greater magnitude occur. Corona current, electric field intensity, and space charge density data from marine thunderstorms on 30 July and 9 August 1978 were analyzed. When fields estimated at 30 kV/m occurred near brackish water, corona currents of 10E-6 A/m flowed from a long wire apparatus to ground. Space charge densities at the shoreline, in the presence of 5 m/sec sea breezes were commonly 1000 to 2000 el. ch. cmE-3 during the same storms. The sign of the space charge was usually positive near sea water and was negative near fresh water. Dissert. Abstr.

N80-27912 Utah Univ., Salt Lake City.
A CYLINDRICAL CLOUD MODEL FOR MICROWAVE AND INFRARED RADIATIVE TRANSFER-APPLICATIONS TO DEFENSE METEOROLOGICAL SATELLITE PROGRAM MICROWAVE SOUNDERS Ph.D. Thesis
Grant Clifford Aufderhaar 1980 160 p
Avail: Univ. Microfilms Order No. 8016358

Analytic solutions to the thermal radiative transfer equation for one and two dimensional cylindrical geometries for an isothermal cloud cylinder are derived using a truncated spherical harmonics expansion for the intensity and scattering phase function. Case studies are presented utilizing Defence Meteorological Satellite Program microwave sounder data along with standard meteorological data. Calculations for nonprecipitating and clear cases were similar and in good agreement with observations. Precipitating cloud cases were simulated well by the cylinder model, while the plane-parallel model failed in cases with higher rainfall rates. Finally, temperature profile retrievals were performed using the Air Force Global Weather Central statistical method. The method was shown to fail in case studies where there was a precipitating cloud in the field of view. Dissert. Abstr.

N80-27913*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ACCURACY OF AIRCRAFT VELOCITIES FROM INERTIAL NAVIGATION SYSTEMS FOR APPLICATION TO AIRBORNE WIND MEASUREMENTS
Richard H. Rhyne Jul. 1980 15 p refs
(NASA-TM-81826; L-13616) Avail: NTIS HC A02/MF A01 CSCL 04B

An experimental assessment was made of two commercially available inertial navigation systems (INS) with regard to their velocity measuring capability for use in wind, shear, and long-wavelength atmospheric turbulence research. The assessment was based on 52 sets of postflight measurements of velocity (error) during a 'Schuler cycle' (84 minutes) while the INS was still operating but the airplane was motionless. Four INS units of one type and two units of another were tested over a period of 2 years after routine research flights similar to air-linetype operations of from 1 to 6 hours duration. The maximum postflight errors found for the 52 cases had a root mean square value of 2.82 m/sec with little or no correlation of error magnitude with flight duration. Using an INS for monitoring ground speed during

landway in a predicted high wind shear situation could lead to landing speeds which are dangerously high or low. L.F.M.

N80-27914*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

METEOROLOGICAL SATELLITES

Lewis J. Allison, ed., Abraham Schnapf (RCA Corp.), Bernard C. Diesen, III (USAF), Philip S. Martin (USAF), Arthur Schwalb (NOAA), and William R. Bandeen Jun. 1980 78 p refs Submitted for publication

(NASA-TM-80704) Avail: NTIS HC A05/MF A01 CSCL 04B

An overview is presented of the meteorological satellite programs that have been evolving from 1958 to the present, and plans for the future meteorological and environmental satellite systems that are scheduled to be placed into service in the early 1980's are reviewed. The development of the TIROS family of weather satellites, including TIROS, ESSA, ITOS/NOAA, and the present TIROS-N (the third generation operational system) is summarized. The contribution of the Nimbus and ATS technology satellites to the development of the operational-orbiting and geostationary satellites is discussed. Included are descriptions of both the TIROS-N and the DMSP payloads currently under development to assure a continued and orderly growth of these systems into the 1980's. Author

N80-27915*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

X-RAY SPECTRAL CONSTRAINTS ON THE BROAD-LINE CLOUD GEOMETRY OF NGC 4151

S. S. Holt, R. F. Muchotzky, R. H. Becker, E. A. Boldt, P. J. Serlemitsos, A. E. Szymkowiak, and N. E. White Jun. 1980 17 p refs Submitted for publication

(NASA-TM-80728) Avail: NTIS HC A02/MF A01 CSCL 04B

X-ray spectral data from NGC 4151 taken with the Einstein Solid-State Spectrometer (SSS) and the HEAO-1 A-2 experiment cannot be simply reconciled with absorption from a uniform column of cold gas. The SSS data can, however, be explained in terms of a clumped absorber with approximately 10% uncovered fraction and factor-of-two overabundances in Z equal to or greater than 14 elements relative to solar oxygen. It is shown that these and previously reported spectral and variability data can be quantitatively reconciled with absorption arising in the cold clouds responsible for the broad optical line emission if the cloud dimensions are small compared to the central source size. It is suggested that the lack of significant X-ray absorption observed from much higher luminosity Seyferts and quasars is a natural consequence of our picture for NGC 4151. Author

N80-27916*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

A PRELIMINARY LOOK AT AVE-SESAME 2 CONDUCTED ON 19-20 APRIL 1979

Steven F. Williams, Nicholas Horvath (Texas A and M, Coll. Station), and Robert E. Turner Jun. 1980 58 p ref

(NASA-TM-78280) Avail: NTIS HC A04/MF A01 CSCL 04B

Preliminary information on data collected, synoptic conditions, and severe and unusual weather reported during the AVE-SESAME 2 period is presented. The information provides researchers a preliminary look at conditions during the AVE-SESAME 2 period. L.F.M.

N80-27917# World Meteorological Organization, Geneva (Switzerland).

CLIMATE MODELS: PERFORMANCE, INTERCOMPARISON AND SENSITIVITY STUDIES, VOLUME 1 Global Atmospheric Research Programme

W. Lawrence Gates, ed. Dec. 1979 615 p refs Proceedings of WMO/ICSU Joint Organizing Comm. Study Conf., Washington, D.C., 3-7 Apr. 1978 Prepared in cooperation with International Council of Scientific Unions, Rome 2 Vol.

(GARP-Publ-22-Vol-1) Avail: NTIS HC A99/MF A01

An overview and intercomparison was made of the seasonal climate simulation capability of different climate models, and of the various general circulation models in particular. Sensitivity studies which have been made with both general circulation models and statistical-dynamical models were reviewed. For individual titles, see N80-27918 through N80-27937.

N80-27918# Princeton Univ., N. J. Geophysical Fluid Dynamics Lab.

OVERVIEW OF THE CLIMATE MODELING PROGRAM

J. Smagorinsky *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 1-12 (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

The derivation of climate models from atmospheric general circulation models is described. The problems of predictability and validation in climate modeling are summarized, and the need for a global data set is indicated. The fundamental differences in opinion as to which physical processes are important in climate modeling are given as justification for greater diversity in research efforts. Author (ESA)

N80-27919# National Center for Atmospheric Research, Boulder, Colo.

REVIEW OF ATMOSPHERIC GENERAL CIRCULATION MODELS

C. E. Leith *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 13-22 refs Sponsored by NSF (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

The application of general circulation models to the study of climate questions is reviewed. The climate noise problem arising from sampling fluctuations, and the nature of the climate signal or response to external forcing influences necessary for determining predictability of the second kind are discussed. The observed one year lagged correlation in summer temperatures in the North American continent and the observed spatial and temporal correlation properties of the Southern Oscillation in the equatorial Pacific region suggest the existence of slow physical processes coupled into the climate system for which model studies would be valuable. It is pointed out that the understanding of the atmospheric blocking phenomenon could have important consequences for predictions of the first kind arising from internal dynamical solutions of the equations of motion for the climate system. Author (ESA)

N80-27920# Princeton Univ., N. J. Geophysical Fluid Dynamics Lab.

MODELS OF THE OCEAN CIRCULATION AND THE GLOBAL HEAT BALANCE

K. Bryan *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 23-40 refs (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

The questions as to what can be learned from existing models about the role of the oceans in the global heat balance, and the potential of ocean models for studying the problem are discussed. It is shown that the least known element in the global heat balance is the role of the ocean in transporting heat poleward and moderating the seasons by heat storage in the upper ocean. The few results available from model calculations that have been analyzed suggest that meridional overturning is the most important mechanism for transporting heat at low latitudes, with horizontal gyres and mesoscale eddies becoming important at higher latitudes. Also the thermohaline circulation and wind-driven overturning act together to transport heat poleward in the trade wind zone. At higher latitudes the wind-driven overturning and the thermohaline circulation tend to oppose each other, diminishing the effectiveness of the ocean meridional heat flux. Author (ESA)

N80-27921# Princeton Univ., N. J. Geophysical Fluid Dynamics Lab.

CLIMATE SIMULATIONS WITH SPECTRAL MODELS OF THE ATMOSPHERE: EFFECT OF SPECTRAL TRUNCATION

S. Manabe, D. G. Hahn, and J. L. Holloway *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 41-94 refs (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

The climate simulation performance of three semi-spectral

models differing only in spectral resolution is evaluated and compared. As the spectral resolution is increased, tropical rainbelts become narrower and better defined, subtropical dry zones expand, and the sea level pressure gradient between the subtropics and subpolar regions increases. While these spectral models maintain a level of eddy kinetic energy which is less than observed, they tend to underestimate the transient component of eddy kinetic energy and overestimate the stationary component. In general, the spectral climate models are able to simulate many of the large scale features of climate, and the quality of the simulations tends to improve with increasing spectral resolution. Comparison is made between the performance of these semi-spectral climate models and that of finite difference climate models. With some exceptions, the simulated climate of the spectral models compare favorably with those of the finite difference models of comparable resolution. Author (ESA)

N80-27922# National Center for Atmospheric Research, Boulder, Colo.

PRELIMINARY ATMOSPHERIC SIMULATION WITH THE THIRD-GENERATION NCAR GENERAL CIRCULATION MODEL: JANUARY AND JULY

W. M. Washington, R. Dickinson, V. Ramanathan, T. Mayer, D. Williamson, G. Williamson, and R. Wolski *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 95-138 refs Sponsored by NSF (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

The first atmospheric simulation results from a general circulation model (GCM) are presented. Although the model is still undergoing development and the results should be viewed as preliminary, the model already shows a greatly improved wind and temperature structure. The computed outgoing longwave radiation and albedo are in good agreement with satellite measurements. The strengths of the midlatitude transports of momentum and sensible heat are up to observed values. Much of this improvement can be credited to better numerical treatment, changes in both solar and longwave radiation, inclusion of convective transports of momentum and moisture, and a method of treating the boundary layer and Earth's surface. Author (ESA)

N80-27923# Oregon State Univ., Corvallis. Dept. of Atmospheric Sciences.

PERFORMANCE OF THE OREGON STATE UNIVERSITY TWO-LEVEL ATMOSPHERIC GENERAL CIRCULATION MODEL

Michael E. Schlesinger and W. Lawrence Gates *In* WMO Climate Models: Performance Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 139-206 refs (For primary document see N80-27917 18-47)

(Contract DAHC15-73-C-0181; Grants NSF ATM-77-16923; NSF ATM-77-28408)

Avail: NTIS HC A99/MF A01

A version of the two level atmospheric general circulation model was developed. The model simulates the large-scale distributions of January and July climate with reasonable accuracy including: the primary climatic variables of pressure, temperature, wind, cloudiness, and precipitation; the simulated meridional distribution of the meridional transports of zonal momentum, heat, and water vapor; the elements of the associated heat and hydrologic balances; and the seasonal energy cycle. The most prominent errors of the model are: a tropical Hadley circulation which is too strong and a midlatitude Ferrel circulation which is too weak in both hemispheres; precipitation and evaporation rates which are too large off the east coasts of the winter hemisphere continents; midlatitude stationary eddies and zonal winds which are too strong; and surface air temperatures which are too high in the winter polar regions. The causes of these errors appear to be related to the subgrid scale vertical flux of momentum and to the treatment of the boundary layer. Author (ESA)

N80-27924*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

COMPARISONS OF OBSERVED SEASONAL CLIMATE FEATURES WITH A WINTER AND SUMMER NUMERICAL SIMULATION PRODUCED WITH THE GLAS GENERAL CIRCULATION MODEL

M. Halem, J. Shukla (MIT, Cambridge), Y. Mintz (California Univ., Los Angeles), M. L. Wu (NAS-NRC), R. Godbole (NAS-NRC), G. Herman (Wisconsin Univ., Madison), and Y. Sud (Sigma Data Services Corp., Inc.) *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 207-253 refs (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01 CSCL 04B

Results are presented from numerical simulations performed with the general circulation model (GCM) for winter and summer. The monthly mean simulated fields for each integration are compared with observed geographical distributions and zonal averages. In general, the simulated sea level pressure and upper level geopotential height field agree well with the observations. Well simulated features are the winter Aleutian and Icelandic lows, the summer southwestern U.S. low, the summer and winter oceanic subtropical highs in both hemispheres, and the summer upper level Tibetan high and Atlantic ridge. The surface and upper air wind fields in the low latitudes are in good agreement with the observations. The geographical distirbutions of the Earth atmosphere radiation balance and of the precipitation rates over the oceans are well simulated, but not all of the intensities of these features are correct. Other comparisons are shown for precipitation along the ITCZ, radiation balance, zonally averaged temperatures and zonal winds, and poleward transports of momentum and sensible heat. Author (ESA)

N80-27925# Meteorological Office, Bracknell (England).

THE METEOROLOGICAL OFFICE 5-LAYER GENERAL CIRCULATION MODEL

A. Gilchrist *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 254-295 refs (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

After a brief description of the main features of the model, results are presented for two separate integrations in which the sea surface temperature, ice cover, and radiation parameters were maintained at their climatological values for January and July. Standard deviations of quantities were calculated from values sampled at daily intervals during the simulation periods. These include sea level pressure, mean 500 mb height, mean rainfall, zonal wind speed, mean meridional circulation, heat transport, zonal momentum transport, and water vapor transport. Author (ESA)

N80-27926# Australian Numerical Meteorology Research Center, Melbourne.

A SIMULATION OF THE JANUARY GLOBAL CIRCULATION USING A SPECTRAL MODEL

B. McAvaney, W. Bourke, and K. Puri *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 296-317 refs (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

The model uses a semi-implicit time integration algorithm for computational economy, has nine levels in the vertical, and employs a horizontal resolution of up to wave number 15 (rhomboidal truncation). The physical parameterizations employed follow closely those of GFDL. Comparisons of model results from the last 30 days of a 104 day integration for perpetual January insolation are made with observed values, for mean sea level pressure, wind field, temperature, 500 mb geopotential field, precipitation, and radiation flux. Author (ESA)

N80-27927# Akademiya Nauk SSSR, Novosibirsk. Computer Center.

NUMERICAL SIMULATION OF THE GLOBAL CIRCULATION OF THE ATMOSPHERE

G. I. Marchuk, V. P. Dymnikov, V. N. Lykosov, V. Ya. Galin, I. M. Bobyleva, and V. L. Perov *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 318-370 refs (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

A description of the model is presented, which, while based upon previous work in the field, introduces some improvements into the process of constructing the difference approximation of differential equations without violating the properties of initial operators. This includes skew-symmetry of operators which makes

it possible to substantiate theoretically the stability of a computing process on the basis of the easily determined law of conservation of quadratic norms. In the model, the splitting up method serves as a methodological basis for the solution of the difference equations. Theoretical substantiation of the method was consecutively developed for all stages of its application. By employing this method, it is possible to eliminate a strict stability criterion, replacing it with an 'easier' and natural approximation criterion. Two numerical experiments on the simulation of mid-January circulation of the atmosphere were made. Comparisons of the calculated and observed global values of kinetic and available potential energy, and other parameters, indicate that the model can be useful for climate simulation studies.

Author (ESA)

N80-27928# Main Geophysical Observatory, Leningrad (USSR).

SIMULATION OF JANUARY CLIMATE WITH A GENERAL CIRCULATION MODEL

V. R. Meleshko, B. E. Shneerov, M. E. Shvets, L. R. Dmitrieva, G. V. Parshina, C. V. Bogachenko, V. A. Ponomarev, E. P. Yushina, L. H. Magazenkov, and D. A. Sheinin *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 371-408 refs (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

The model is described briefly. Simulation of the January climate was chosen because the atmospheric processes associated with the development and realization of baroclinic instability, as well as interactions between the oceans and the atmosphere, are well exposed in the winter. Comparisons of model output with observations show that the model is capable of simulating some general features of the mean atmospheric circulation in January, namely the temperature, wind and sea surface pressure distributions and the heat and water balance components. Deficiencies of the model concern the inadequate vertical resolution of the model atmosphere, which causes some problems in the description of the heat sources, and poor spectral selectivity of the horizontal diffusion scheme used. The diffusion scheme, based on the deformation approach, damps disturbances with wavenumbers 1 to 4 rather significantly. The ratio of the eddy kinetic energy to zonal energy is approximately 0.28 for January in the present version of the model. Author (ESA)

N80-27929# Atmospheric Environment Service, Downsview (Ontario).

THE ATMOSPHERIC GENERAL CIRCULATION MODEL

G. J. Boer and N. A. McFarlane *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 409-460 refs (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

The model, in the developmental stage, contains the following features which make it appreciably different from others: spherical harmonic representation of the variables in the horizontal, semi-implicit time stepping, and subgrid scale diffusion of the Leith type. The model is described in some detail. A 90 day integration using as initial conditions an analysis from the GARP global data set for 4 Nov. 1969 was made. The results, although exhibiting certain apparent difficulties, are not widely at variance with the results of other general circulation models (GCM) or with the observed atmosphere. In particular, the use of a spectral model, together with an appropriate formulation of subgrid-scale dissipation, has apparently overcome one of the shortcomings of grid-point GCM s, namely that of insufficient eddy kinetic energy. Author (ESA)

N80-27930# National Center for Atmospheric Research, Boulder, Colo.

RESPONSE OF THE NCAR GENERAL CIRCULATION MODEL TO CHANGED OCEAN SURFACE TEMPERATURE

R. M. Chervin *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 461-481 refs Sponsored by NSF (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

Several prescribed change experiments with various versions of the NCAR general circulation model which attempt to assess the sensitivity of the model to changed ocean surface temperatures are reviewed. One such experiment involving altered temperatures in the tropical eastern Pacific Ocean is discussed in detail. The model response in this case features a relative thermally direct circulation driven primarily by the latent heat of condensation. The interaction between the dynamics and thermodynamics is evident since the maximum atmospheric response (in terms of cloudiness and precipitation) to increased ocean surface temperature occurs westward of the largest temperature increases, and the subtropical jet stream north of the prescribed change region is significantly affected. Furthermore, these model results indicate that at least this particular version of the NCAR general circulation model is relatively more sensitive to tropical as opposed to midlatitude ocean surface temperature anomalies. Author (ESA)

N80-27931# Meteorological Office, Bracknell (England).

STATISTICAL ASSESSMENTS OF SEA TEMPERATURE ANORMALY EXPERIMENTS

P. R. Rowntree *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 482-500 refs (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

Two aspects of the statistical assessments of anomaly experiments carried out with atmospheric models are described. The first concerns the interpretation of results of Student's t-test with particular reference to assessing the probability of particular results occuring by chance. The second concerns a correlation technique which can be applied with small samples or when a pair (control and anomaly) of experiments are made with different models. The effects of extratropical anomalies were not detectable using these statistical techniques. The tropical anomalies studies produce highly significant effects in the model tropics. The t-test provides strong evidence of significant effects in other latitude bands, especially the subtropics and (for the tropical Pacific anomalies) middle latitudes of the Northern Hemisphere.

Author (ESA)

N80-27932*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

EFFECT OF A PACIFIC SEA-SURFACE TEMPERATURE ANOMALY ON THE CIRCULATION OVER NORTH AMERICA: A NUMERICAL EXPERIMENT WITH THE GLAS MODEL

J. Shukla (MIT, Cambridge) and B. Bangaru (Sigma Data Services Corp., Inc.) *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 501-518 refs (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01 CSCL 04B

A numerical experiment was carried out to determine the effect of sea surface temperature anomalies over the Pacific on the circulation over North America. The sea surface temperature (SST) anomaly pattern chosen for this study was similar to the one observed during January 1977. It is shown that a cold sea surface temperature anomaly over the Pacific produces a strong southward flow over the United States and colder temperature in eastern Canada and the United States, as it was observed during the 1977 winter. The results indicate that the SST anomaly over the Pacific can produce a significant downstream effect over the continental United States. Author (ESA)

N80-27933# Reading Univ. (England). Atmospheric Modelling Group.

A SIMPLE MODEL OF THE ATMOSPHERIC RESPONSE TO A TROPICAL SEA-SURFACE TEMPERATURE ANOMALY

B. J. Hoskins and A. J. Simmons *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 519-524 refs (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

The linearized barotropic vorticity equation is used, with tropical forcing of divergence, to model the effect of the temperature anomaly on the 300 mb flow. The 30 day averages produced by a hemispheric model using the winter climatological zonal flow and an elliptical forcing show good agreement with the observed January 1963 height field anomaly. Author (ESA)

N80-27934# International Institute for Applied Systems Analysis, Laxenburg (Austria).

GENERAL CIRCULATION MODEL EXPERIMENTS USING

GLACIAL PERIOD AND RELATED BOUNDARY CONDITIONS

Jill Williams *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 525-537 refs (For primary document see N80-27917 18-47)
Avail: NTIS HC A99/MF A01

The NCAR general circulation model was used to simulate the atmospheric circulation with boundary conditions representing these of the last glacial period maximum and a July with extensive *snow cover and glacial period sea surface temperatures. A January* and July control case was run with present day boundary conditions (albedo, orography, and sea surface temperature). *Results of the experiments are presented for the following* parameters: sea level pressure; pressure at 6 km; the zonally averaged u component of the wind; and cyclone tracks. Surface *temperature, kinetic energy, Hadley circulation, and specific* humidity variability are also discussed. Author (ESA)

N80-27935*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE RESPONSE OF THE GODDARD GENERAL CIRCULATION MODEL TO SEA ICE BOUNDARY CONDITIONS

G. G. Herman (Wisconsin Univ., Madison) and W. T. Johnson (Sigma Data Service Corp., Inc.) *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 538-562 refs (For primary document see N80-27917 18-47)
(Grant NsG-5152)
Avail: NTIS HC A99/MF A01 CSCL 04B

The effect of variation in the location of Arctic sea ice boundaries on the model's mean monthly climatology was examined. When sea ice boundaries were at their maximum *extent the differences resulted in the January-February climatol-*ogy. Sea level pressure was higher over the Barents Sea, in the Davis Strait, and in the Sea of Okhotsk. Pressure was lower *by as much as 8 mb in the North Atlantic between Iceland and* the British Isles, and in the Gulf of Alaska. Pressure rises in the *eastern subtropical regions of the North Atlantic and North Pacific accompanied pressure falls in the Gulf of Alaska and Icelandic* region. Geopotential heights at 500 mb were more than 100 gpm *lower in the Bering Sea, and more than 120 gpm lower in the* Icelandic region. Zonally averaged temperatures were cooler by 4 deg C below 3800 mb between 50 deg and 70 deg N with *little change elsewhere. Zonally averaged geopotentials were lower* by as much as 70 gpm in the mid-troposphere between 50/-70 deg N and zonal winds increased by as much as 3 m s *in the mid-troposphere between 35/-50 deg N.* Author (ESA)

N80-27936# National Center for Atmospheric Research, Boulder, Colo.

RESPONSE OF THE NCAR GENERAL CIRCULATION MODEL TO CHANGED LAND SURFACE ALBEDO

Robert M. Chervin *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 563-581 refs *Sponsored by NSF* (For primary document see N80-27917 18-47)
Avail: NTIS HC A99/MF A01

A series of experiments with a July version of the model was performed to assess the model's response to changes in *the prescribed surface albedo for the United States High Plains* and the Sahara Desert. These experiments confirm the earlier hypothesis that large scale increases in surface albedo result in *reduced precipitation over the prescribed change region and* increased precipitation to the south. The statistical significance of the results (both local and global), the physical mechanisms *involved, and implications for desertification are discussed.*
Author (ESA)

N80-27937# National Center for Atmospheric Research, Boulder, Colo.

SAMPLING CONSIDERATIONS IN ESTIMATING SECOND MOMENT CLIMATE QUANTITIES

Robert M. Chervin *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 582-606 refs Sponsored by NSF (For primary document see N80-27917 18-47)
Avail: NTIS HC A99/MF A01

The inherent variability which exists in the climatic means *(monthly, seasonal, etc.) simulated by general circulation models* (GCM's) is an analog to the natural variability occurring in real atmospheric statistics derived from observations in several *different years. From a sampled ensemble of five independent* realizations of a perpetual January version of the NCAR GCM, it is also shown that considerable inherent variability exists in *the time average estimates of variance of model fields, that is,* there is a sizeable variance of the variance. For this same sampled ensemble, estimates are made of the characteristic time (T sub *0) between effectively independent sample values. These* estimates are based on the estimated time average variances and the variances of the means of the means for each realization. *Due to sampling consideration, uncertainties also exist in these* estimates of T sub 0. Author (ESA)

N80-27938# World Meteorological Organization, Geneva (Switzerland).

CLIMATE MODELS: PERFORMANCE, INTERCOMPARISON AND SENSITIVITY STUDIES, VOLUME 2 Global Atmospheric Research Programme

W. Lawrence Gates, ed. Dec. 1979 449 p refs Proceedings of WMO/ICSU Joint Organizing Comm. Study Conf., Washington, D.C., 3-7 Apr. 1978 Prepared in cooperation with International *Council of Scientific Unions, Rome, Italy 2 Vol.*
(GARP-Publ-22-Vol-2) Avail: NTIS HC A19/MF A01

An overview and intercomparison was made of the sea-*sonal climate simulation capability of different climate models,* and of the various general circulation models in particular. Sensitivity studies which have been made with both general *circulation models and statistical dynamical models were reviewed.* For individual titles, see N80-27939 through N80-27959.

N80-27939*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Lab. for Atmospheric Sciences.

ON THE SIMULATION OF THE OCEANIC GENERAL CIRCULATION

Y. Mintz *In* WMO Climate models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 607-687 refs (For primary document see N80-27938 18-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Two global ocean simulations based on the physics of a *highly viscous ocean are discussed, one having realistic atmo-*spheric functions for calculating the thermal forcing of the ocean. The velocity field of this model compares reasonably well with *the relatively small amount of real data available.* Temperature and heat budget components of the model reproduce best the equatorial band of heating. A simulation based upon the physics *of a weakly viscous ocean is described, which produces the* correct pattern of isotherms. This model has not yet been run to thermal equilibrium. The Gulf Stream and eddies and their *influence on the oceanic and atmospheric heat budgets are* discussed in the terms of their importance in coupled ocean-*atmosphere models.*
Author (ESA)

N80-27940# Oregon State Univ., Corvallis. Dept. of Atmospheric Sciences.

THE ANNUAL VARIABILITY OF SEA SURFACE TEMPERATURE: OBSERVATION AND SIMULATION

J.-W. Kim and W. L. Gates *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 688-714 refs (For primary document see N80-27938 18-47)
(Grant NSF OCE-76-80182)
Avail: NTIS HC A19/MF A01

The mean annual variability of the sea surface temperature on the large scale as determined from observations is simulated by two runs of an oceanic general circulation model with and without an imbedded surface mixed layer. The comparative *simulations suggest a strong role of turbulent mixing in the* mean annual variability of sea surface temperature, whereas an intercomparison of the observed annual variabilities of surface forcing functions and sea surface temperature suggests the importance of the advective redistribution of heat. The turbulent *mixing and advection are likely to be important also in modeling* the large-scale structure of the short-term interannual variability.
Author (ESA)

N80-27941# Missouri Univ. -St. Louis. Dept. of Physics.
SIMPLE SEASONAL CLIMATE MODELS
G. R. North and J. A. Coakley (National Center for Atmospheric Research) *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 *p 715-727* refs Sponsored by NSF (For primary document see N80-27938 18-47)
Avail: NTIS HC A19/MF A01

The largest scales of the zonally averaged temperature, albedo, infrared flux, and solar flux are represented by a few terms in a Fourier-Legendre expansion in latitude and a Fourier series in time. Prior to fitting, the data were symmetrized so that only data from the Northern Hemisphere were used. A simple energy balance climate model is constructed with diffusive heat transport and an albedo value jump on a snow line which follows a specific isotherm. In order to achieve the proper seasonal temperature field it is necessary to consider the land and ocean-covered areas separately. It is suggested that such models might be useful in the study of sensitivity of the temperature field to changes in various climate forming parameters.
Author (ESA)

N80-27942# National Center for Atmospheric Research, Boulder, Colo.
VERIFICATION OF PARAMETERIZATIONS IN CLIMATE MODELING
Stephen H. Schneider *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 728-751 refs Sponsored by NSF (For primary document see N80-27938 18-47)
Avail: NTIS HC A19/MF A01

The performance of climate models is discussed in relation to their response to externally forced physical changes. It is suggested that a satisfactory performance in the following areas will improve the confidence of the user in the veracity of the model: model resolution; physical comprehensiveness; performance of individual physical parameterizations against independent data; simulation of equilibrium climate data; and response to nature's sensitivity experiments (seasonal cycle, volcanic dust veils, orbital variations). Author (ESA)

N80-27943# Missouri Univ. -St. Louis. Dept. of Physics.
RECENT WORK ON HEAT-BALANCE MODELS
Gerald R. North *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 752-765 refs Sponsored by NSF (For primary document see N80-27938 18-47)
Avail: NTIS HC A19/MF A01

The solution properties of climate models of the Budyko-Sellers type are surveyed. One group of model studies attempts to improve the parameterization in the heat balance equation with better formulas and the latest observational data. A second group involves theoretical studies which are attempts to understand the nature of the climate solutions in a way that is more or less independent of the numerical values of the various empirical constants. Slope stability theorems and parameter independent proofs for certain classes of models are discussed, particularly as they relate to the tendency of models which have ice lines attached to isotherms and assume a constant cloud cover function, to plunge to an ice-covered Earth. The extension of the simple models to include seasonal effect and their failure to explain the Milankivitch effect is mentioned. Author (ESA)

N80-27944*# Maryland Univ., College Park. Meteorology Program.
THE PERFORMANCE OF A SEASONAL GLOBAL CLIMATIC MODEL Ph.D. Thesis - MIT
Alan Robock *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 766-802 refs (For primary document see N80-27938 18-47)
(Grants NsG-5209; NSF OCD-74-03969)
Avail: NTIS HC A19/MF A01 CSCL 04B

A seasonal global climatic model developed by Sellers is studied. Several changes are made to correct errors in the original model and to allow its use in a time dependent simulation mode. The major changes are in the infrared radiation formulation and in the size of the time steps. The seasonal cycles of surface temperature, wind, ice, snow, albedo, horizontal heat transport, and vertical flux of solar and infrared radiation are compared to recent observations. The seasonal cycle of temperature is fairly well reproduced, but has too small an amplitude in the Northern Hemisphere high latitudes. An overestimate of albedo at the poles is found, which is related to errors in some of the other variables. The sensitivity of the model to CO2 and solar constant (Q) changes is summarized. Doubling the CO2 amount causes a 2.45 K increase in global average surface temperature (T). Increasing Q by 1% increases T by 3.14K. Decreasing Q by 1% decreases T by 4.65K. An annual average version of the model is more sensitive to changes in Q than the model with the seasonal cycle. Author (ESA)

N80-27945# Yale Univ., New Haven, Conn. Dept. of Geology and Geophysics.
EQUILIBRIUM CLIMATIC ZONATION DEDUCED FROM A STATISTICAL-DYNAMICAL MODEL
B. Saltzman *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 803-841 refs (For primary document see N80-27938 18-47)
Avail: NTIS HC A19/MF A01

A model containing a parameterization of the meridional eddy flux of momentum, as well as most of the important elements of a complete theory of the zonal mean state including the hydrologic cycle is described. The following approximations are applied to the hydrostatic equations governing the zonal and time averaged atmospheric variables: the climatic average is taken for a winter and summer half year; the atmosphere is assumed to be in an equilibrium state; transports due to stationary waves are neglected; and mean zonal motions are assumed to be negligible compared to the surface friction. Calculations for present global boundary conditions show that a satisfactory first approximation to the observed climatic zonation can be deduced, including the main differences between the seasons and the hemispheres. There is agreement with observations for the energy fluxes and atmospheric heating. When the model is applied to the surface ice conditions prevailing during the glacial maximum at 17,000 BP, an equilibrium state is obtained that qualitatively agrees with other dynamical modeling experiments.Author (ESA)

N80-27946# Imperial Coll. of Science and Technology, London (England). Dept. of Physics.
EXPERIMENTS WITH SOME SIMPLE ZONAL AVERAGE AND LONG WAVE ATMOSPHERIC MODELS
A. A. White *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 842-851 refs (For primary document see N80-27938 18-47)
Avail: NTIS HC A19/MF A01

Two models using Green's scheme for the parameterization of baroclinic eddies were designed to test the applicability of this scheme in climate-scale integration. Both are two parameter beta plane formulations. Integrations with the zonal average model made for winter and summer conditions give acceptable qualitative reproduction of atmospheric behavior, but with a weak mean meridional circulation. Integration with a long wave winter model shows that forced long waves contribute slightly to the total eddy flux of potential temperature, and more substantially to the total eddy flux of zonal motion. Author (ESA)

N80-27947# California Univ., Livermore. Lawrence Livermore Lab.
PERFORMANCE OF THE LAWRENCE LIVERMORE LABORATORY ZONAL ATMOSPHERIC MODEL
G. L. Potter, H. W. Ellsaesser, M. C. MacCracken, and F. M. Luther *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 852-871 refs (For primary document see N80-27938 18-47)
(Contract W-7405-eng-48)
Avail: NTIS HC A19/MF A01

The two dimensional model uses primitive conservation equations, and is designed to assess the potential climatic effects of atmosphere and surface perturbations, and to study climatic feedback mechanisms. The model is divided vertically into nine pressure layers. The prognostic variables are temperature, water vapor mixing ratio, surface pressure, and wind velocity. Surface fluxes of sensible heat and moisture and fractional cloud cover are calculated. Precipitation and convection are parameterized. The land surface boundary is divided into layers which may be

snow, ice, or land, with surface temperature calculated by type. The ocean is an isothermal layer 50 m thick, and accommodates sea ice of varying thickness and extent. Data from a two year integration of the seasonal version compare well with other general circulation model experiments and observations for cloud cover, precipitation, air temperature, evaporation, sensible heat flux, albedo, radiative flux, and reflected and absorbed solar radiation. Author (ESA)

N80-27948# Harvard Univ., Cambridge, Mass.
A SEVERELY TRUNCATED SPECTRAL MODEL
Isaac M. Held *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 872-880 refs (For primary document see N80-27938 18-47)
Avail: NTIS HC A19/MF A01

Results from a two level primitive equation model are summarized in terms of its value in studying climate variability and sensitivity. Numerical experiments were conducted with a two wave, 3 to 6 model. In one set of experiments, surface albedo and cloud were fixed and the solar constant varied. Two versions of the model were utilized, one 'moist' and the other 'dry'. In the dry cases, the poleward flux increases 2.5% for each 1% increase in solar constant. This increase in poleward flux is sufficient to force the meridional temperature gradient to decrease slightly, in spite of the increased meridional radiation gradient. In the moist model, the potential temperature flux increases in high latitude, but not in low latitudes, as the solar constant increases. Other experiments were performed to study the large ice-cap instability. It was found that when the solar constant was lowered a few percent, the ice cap does become unstable to growth, but does not continue growing until the Earth is ice-covered. An additional decrease in the solar constant of 5% is required to destabilize it. Author (ESA)

N80-27949# Reading Univ. (England). Atmospheric Modeling Group.
TRANSPORTS BY NONLINEAR BAROCLINIC WAVES
B. J. Hoskins and A. J. Simmons *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 881-885 refs (For primary document see N80-27938 18-47)
Avail: NTIS HC A19/MF A01

Integrations were made with a 15 layer primitive equation model which uses a spectral representation in the horizontal, truncated triangularly at total wavenumber N = 42. Some runs were made with a truncation at N = 63. A zonal flow is specified and, for a particular zonal wavenumber, the most unstable normal mode derived. The zonal flow plus the normal mode with a very small amplitude is then used as initial condition for a nonlinear integration. When averaged over their life cycles all the wavenumber 6 baroclinic waves give qualitatively similar transports of momentum and heat. The transport of momentum is principally poleward. The extreme life cycle values of the transport of momentum vary by almost a factor of 3. The wavenumber 9 heat transport remained low level but all the wavenumber 6 disturbances deepened such that the average heat transport varied little with depth. It is seen that baroclinic waves and their transports are very sensitive to wavenumber and to barotropic components in the basic flow. Linear theory does not give a good qualitative indication of momentum transports and gives little idea of the life cycle averaged values of any transport. Author (ESA)

N80-27950*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN ENERGY-BALANCE MODEL OF GLACIATION CYCLES
M. Ghil (New York Univ.) and K. Bhattacharya (Columbia Univ.) *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 886-916 refs (For primary document see N80-27938 18-47)
(Grants NsG-5130; NsG-5138)
Avail: NTIS HC A19/MF A01 CSCL 04B

A one dimensional energy balance model is presented which contains a time lagged albedo to account for the delayed dependence of continental ice sheets on temperature; it also includes a smoothing of temperature gradients in the tropics to account for the effect of the Hadley circulation on the strong flattening of meridional temperature profiles there. The model exhibits finite amplitude, sustained free oscillations; these oscillations are triggered by a change in the insulation parameter and occur in the absence of any external forcing. This model behavior strongly suggests the possibility of an almost-intransitive mechanism playing a role in glaciation cycles. This behavior also occurs on shorter time scales which might be relevant to the interannual variability of the atmosphere. Author (ESA)

N80-27951# Yale Univ., New Haven, Conn. Dept. of Geology and Geophysics.
A SIMPLE SEA-ICE/OCEAN-TEMPERATURE OSCILLATOR MODEL
B. Saltzman *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 917-933 refs (For primary document see N80-27938 18-47)
Avail: NTIS HC A19/MF A01

An idealized, mechanistic, thermodynamic model was considered in which the Earth is covered by ocean and there are no seasonal variations. The rate of melting and freezing at the ice edge is determined from the surface heat balance condition. The heat balance condition includes downward flux of heat at the surface due to short and long wave radiation, atmospheric conduction and convection, evaporation, and subsurface conduction and convection. The ocean heat balance equation is integrated to obtain an equation for the rate of change of the mean ocean temperature. Physical constants and empirical values of climatic variables are used to evaluate the equilibrium values. A linear analysis is shown for one set of values showing the possibility that the terrestrial climatic system can exhibit internal free oscillations having periods ranging up to several thousand years. Author (ESA)

N80-27952# National Center for Atmospheric Research, Boulder, Colo.
ZONAL AND SEASONAL RADIATIVE EFFECTS OF A DOUBLING OF ATMOSPHERIC CARBON DIOXIDE CONCENTRATION
V. Ramanathan *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 934-946 refs Sponsored by NSF (For primary document see N80-27938 18-47)
Avail: NTIS HC A19/MF A01

Results are presented of the seasonal and latitudinal radiative heating of the surface and troposphere for a doubling of the CO2 concentration from the present day value. It is shown that the vertical distribution of CO2 radiative heating is a strong function of latitude. At the equator the tropospheric heating is a factor of 2.5 larger than the surface heating while at the polar regions the surface heating is larger than the tropospheric heating by a factor of about 2.5. The results also indicate that at the middle and high latitudes the heating is maximum during summer and minimum during winter. At high latitudes (i.e., poleward of 70/deg) the Southern Hemisphere heating rates are significantly smaller than the Northern Hemisphere heating rates. The seasonal, latitudinal, and interhemispheric differences in CO2 heating rates are caused by: (1) the temperature dependence of the 15 micrometer Planck function and the opacity of CO2 hot bands, and (2) the overlap of CO2 and H2O bands in the 12 to 18 micrometer region. Author (ESA)

N80-27953# General Motors Research Labs., Warren, Mich. Physics Dept.
INFLUENCE OF AIRBORNE PARTICLES ON THE EARTH'S RADIATION BALANCE
Ruth A. Reck *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 947-973 refs (For primary document see N80-27938 18-47)
Avail: NTIS HC A19/MF A01

The Manabe-Wetherald radiative-convective model with parameterized background aerosols was used to demonstrate the radiative, convective, and thermal role of aerosols. Aerosols are found to cool the atmosphere, reduce convection, and increase the planetary albedo. Global seasonal aerosol effects (due to surface albedo changes) are small but polar seasonal effects may be expected to be appreciable. Aerosol optical properties are found to be most important for small sized aerosols and for longer wavelengths. They have been demonstrated to produce nonlinear effects with other simultaneous parameter changes.

Background aerosols produce an order to magnitude less surface temperature change than the same percentage changes in surface albedo and relative humidity. Their thermal effect is one third as significant as the same percentage changes in CO2.

Author (ESA)

N80-27954# State Univ. of New York at Buffalo. Dept. of Biophysical Sciences.

HARMONIC ANALYSIS OF FEEDBACKS: A TRANSFER FUNCTION CLIMATE MODEL

Fred M. Snell, Paul S. Lee, and Paul Wolfson *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 974-994 refs (For primary document see N80-27938 18-47)

Avail: NTIS HC A19/MF A01

The physics describing climate dynamics are represented in a series of operators that transform one climatic data set into another. The relationships between zonally averaged intra-annual climatological data sets are analyzed zone by zone, in order to calculate the cumulative annual gain and the net power weighted and properly phased gain. The calculated relationships are in effect transfer functions mapping one data set onto another either in time (within the annual cycle) or in space (along the meridional coordinate) or both. Annual averaged and zonally averaged climatic statistics are assembled sequentially in a closed loop to create an interannual climate model. It is shown that by altering the distribution of the solar insolation according to the astronomical theory of glaciation proposed by Milankovitch, the resultant temperature field at 71,000 and 24,000 YBP was consistent with that expected at the maximum of the last glacial period, whereas that of 11,000 YBP had markedly warmer poles, probably sufficient for glacial melt.

Author (ESA)

N80-27955# California Univ., Livermore. Lawrence Livermore Lab.

CLIMATE EXPERIMENTS: ALBEDO EXPERIMENTS WITH A ZONAL ATMOSPHERIC MODEL

G. L. Potter, H. W. Ellsaesser, M. C. MacCracken, and F. M. Luther *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 995-1001 refs (For primary document see N80-27938 18-47)

(Contract W-7405-eng-48)

Avail: NTIS HC A19/MF A01

Experiments were designed to simulate the climatic effects resulting from tropical deforestation and desertification from overgrazing. For the first experiment, the surface characteristics were modified for that fraction of the land surface type that could be characterized as tropical rain forest (0.34) in the latitudinal band from 5 deg N to 5 deg S. Model response included: reduced equatorial absorption of solar radiation; an increase in tropospheric lapse rates; a reduction in evaporation rate; weakened Hadley circulation; and an increase in precipitation in the latitude bands adjacent to the equator. The increased surface albedo and consequent reduced surface absorption of solar radiation associated with the desertification experiment resulted in a similar chain of events except that the effect on the Hadley circulation was reversed. These zonal model experiments with modified surface boundary conditions suggest an initial chain of feedback processes that is largest at the site of the perturbation with the possibility that self-induced growth of the subtropical deserts could serve as a possible mechanism to cause the initial global cooling that then initiates a glacial advance, thus activating the positive feedback loop involving ice-albedo feedback.

Author (ESA)

N80-27956# National Center for Atmospheric Research, Boulder, Colo.

DEVELOPMENT OF A SEASONALLY-VERIFIED PLANETARY ALBEDO PARAMETERIZATION FOR ZONAL ENERGY BALANCE CLIMATE MODELS

Starley L. Thompson *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 1002-1023 refs Sponsored by NSF (For primary document see N80-27938 18-47)

Avail: NTIS HC A19/MF A01

A comparison of the monthly observations of planetary albedo was made with a parameterization using the Cess cloud albedo-zenith angle relationship in order to test the suggestion that the latitudinal variation in mean annual planetary albedo appears to be caused largely by the solar zenith angle dependence of the cloud albedo. The parameters and their derivation for ozone absorption Rayleigh scattering, water vapor absorption, dry and wet aerosol scattering, cloud, ocean, and land are shown. Computed and observed zonal distribution of the annual mean planetary albedo show good agreement, as does the seasonal variation. To estimate the relative influence that seasonal variation in temperature and solar zenith angle have on the planetary albedo, an experiment was performed in which the temperature is held fixed at each latitude at its mean annual value. This eliminates all temperature dependent seasonal albedo changes in the parameterization. The use of mean annual temperatures reduces the seasonal albedo variation by about one third.

Author (ESA)

N80-27957# Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.

VIEWS OF THE FUTURE DEVELOPMENT, APPLICATION AND VALIDATION OF GENERAL CIRCULATION MODELS

A. E. Gill *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 1024-1029 ref (For primary document see N80-27938 18-47)

Avail: NTIS HC A19/MF A01

Validation of ocean models for use in air-sea interaction studies involves testing their ability to predict sea surface temperatures. Sufficient data are now available to study both seasonal variations in surface temperature, and variations in currents with periods up to five years. Developments in ocean models and atmospheric models are at a point where linked models should be used to study the southern oscillation. A quantitative measure of the performance of atmospheric models in predicting those fields most relevant for climate questions is suggested.

Author (ESA)

N80-27958# Princeton Univ., N. J. Geophysical Fluid Dynamics Lab.

SOME PERSONAL VIEWS ON THE USE OF GENERAL CIRCULATION MODELS

Abraham J. Oort *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 1030-1036 refs (For primary document see N80-27938 18-47)

Avail: NTIS HC A19/MF A01

It is suggested that general circulation models may be profitably used in the near future to study the pronounced seasonal cycle with superimposed year to year variations in the observed mean temperature of the Earth. Other areas of interest are: polar cap energy balance, the diurnal variation, the role of biology in the chemical evolution of the oceans and atmosphere, and further testing the adequacy of observational networks.

Author (ESA)

N80-27959# Max-Planck-Institut fuer Meteorologie, Hamburg (West Germany).

SOME COMMENTS ON THE DESIGN OF MODEL RESPONSE EXPERIMENTS FOR MULTI-TIME-SCALE SYSTEMS

K. Hasselmann *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 1037-1047 refs (For primary document see N80-27938 18-47)

Avail: NTIS HC A19/MF A01

It is shown that the natural climatic noise spectrum contains most of its variance in the same frequency range as the response function of the system. In a simple model of natural climate variability, the spectrum is actually given by the system response function applied to white noise. Enhanced signal-to-noise ratios must be obtained by ensemble averaging over a series of experiments, using identical changes in the boundary conditions or initial values, but different noise realizations. A strategy is presented for coupling models designed for different time scale ranges into a combined model covering a broader range of time scales. The more rapidly changing system can be regarded as being in a state of statistical quasi-equilibrium on the time scales characteristic of the evolution of the slowly changing system, and can therefore be parameterized by averaging over a time interval intermediate between the characteristic time scales of the two.

Author (ESA)

N80-27960# Oregon State Univ., Corvallis. School of Oceanography.
ANALYSIS OF METEOROLOGICAL OBSERVATIONS FROM AN ARRAY OF BUOYS DURING JASIN M.S. Thesis
Hiroshi Ishida Jan. 1980 75 p refs
(Contracts N00014-76-C-0067; N00014-79-C-0004; NR Proj. 083-102)
(AD-A084034; Rept-80-2) Avail: NTIS HC A04/MF A01 CSCL 04/2

Observations of wind speed and direction, air and sea temperature, and solar radiation were obtained from an array of buoys in JASIN. The observations were analyzed to show spatial and temporal variability. Spectra of wind speed and air and sea temperature were computed to illustrate the distribution of variance over periods ranging from 3.5 minutes to 40 days. When plotted on log-log graphs the spectral estimates generally decrease with increasing frequency with slopes between -3/2 and -2. Spectra of air and sea temperature have a peak at the diurnal frequency. When plotted in variance-preserving form, the spectrum of wind speed is consistent with a spectral gap and is qualitatively similar to other observations of low frequency spectra. On the basis of a cross-correlation analysis, it appears that mesoscale eddies propagated with the mean wind speed except during frontal passages. Based on the cross-correlation between wind and air temperature, there is evidence of horizontal roll vortices or organized convection. GRA

N80-27961# National Aviation Facilities Experimental Center, Atlantic City, N. J.
A STUDY OF THE USE OF METEOROLOGICAL SATELLITE, WEATHER RADAR, AND INTEGRATED GRAPHICS PRODUCTS IN THE FLIGHT SERVICE STATION SYSTEM Final Report, Nov. 1977 - Mar. 1978
T. D. Boldt Apr. 1980 28 p
(FAA Proj. 131-402-814)
(AD-A084012; FAA-NA-79-38; FAA-RD-79/92) Avail: NTIS HC A03/MF A01 CSCL 04/2

A study was conducted on the use of meteorological satellite imagery, weather radar imagery, and computer-generated meteorological graphics in the automated flight service station (FSS). The present meteorological satellite network and image distribution system is explained. The use of image processing of meteorological satellite imagery was investigated. The National Weather Service, Federal Aviation Administration, and United States Air Force's plans for improved weather were investigated. The use of computer-generated and animated graphics for display of meteorological information was investigated. The study concluded that: (1) satellite imagery could be made available in the near term by utilizing components of the present closed circuit television system; (2) the National Weather Service (NWS) network of WSR-57 weather radars provides the best available information for small area detection and depiction of precipitation; and (3) integration of satellite imagery and weather radar imagery will help the specialist in recognizing and interpreting the information available to him. The study recommended: (1) implementation of present video disc and cathode-ray tube technology for electronically storing, displaying, and sequencing satellite images and NWS facsimile weather charts at FSS's; and (2) various studies as to application of available image processing techniques to meteorological satellite images, application of monochromatic and color displays for satellite imagery, and techniques to automatically derive graphic products from the Federal Aviation Administration Service A circuit. GRA

N80-27962# Ben Gurion Univ. of the Negev, Beersheva (Israel). Inst. for Desert Research.
DESERT CONVECTION CLOUDS Final Report, 1 Nov. 1976 - 31 Oct. 1979
Louis Berkofsky Hanscom AFB, Mass. AFGL 12 Feb. 1980 7 p
(Grant AF-AFOSR-3159-77; AF Proj. 2301)
(AD-A083965; AFGL-TR-80-0140) Avail: NTIS HC A02/MF A01 CSCL 04/2

Equipment is being set up to measure various properties of desert clouds. The equipment includes a 3 cm. radar, a 0.86 cm vertically pointing radar, a GMD-1 rawinsonde, 12 weighing bucket rain gauges, cameras for stereophotography of clouds. The measurements will include cloud base, cloud height, growth rate of clouds, cloud base radius, rainfall rates, liquid water content, ambient atmosphere temperature, humidity, wind. Along with the observational set-up, a one dimensional time dependent plume model has been developed for predicting growth of desert clouds. The program is almost completely checked out. Information from the above-mentioned observational program will be used as input data and as verification data for the model. GRA

N80-27963# California Univ., Berkeley. Statistical Lab.
COMMENTS ON THE SPECIAL ISSUE OF COMMUNICATIONS IN STATISTICS (VOLUME A8, NO. 10) CONCERNED WITH WEATHER MODIFICATION EXPERIMENTS
Jerzy Neyman Nov. 1979 21 p refs
(Contract N00014-75-C-0159; Grant DAAG29-76-G-0167)
(AD-A083628; ONR-79-06) Avail: NTIS HC A02/MF A01 CSCL 04/2

As stated by the Editors of the Special Issue, it was compiled with reference to two of my statements: (1) that much of the current weather modification literature is slanted and unreliable, and (2) that progress in the building of a reliable weather modification technology requires an interdisciplinary study of as many completed cloud seeding experiments as possible. The material published in the Special Issue related to two completed experiments, the Tasmania and the Israeli experiments. It is shown that a realistic appraisal of a completed experiment requires a prolonged effort, including an examination of quite a few relevant publications and, on occasion, some numerical work on published raw data. It appears that an interdisciplinary reanalysis of the Tasmania experiment can contribute to the development of a reliable cloud seeding technology. GRA

N80-27964# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
MICROPHYSICAL PROPERTIES OF A LARGE SCALE CLOUD SYSTEM Interim Report, 1-3 Mar. 1978
Donald J. Varley 7 Jan. 1980 100 p refs
(AF Proj. 2310)
(AD-A083140; AFGL-TR-80-0002; AFGL-ERP-690) Avail: NTIS HC A05/MF A01 CSCL 04/2

This report describes the microphysical properties observed by a specially-instrumented C-130 while flying in portions of a large cloud system on 3 successive days in March 1978. Each of the flights was made slightly east of an upper level trough as it moved across the U.S. Horizontal sampling passes of 50 to 100 nm (93 to 186 km) in length were made at various levels from approximately 2 to 9 km above ground in portions of the cloud system that were relatively homogeneous horizontally and vertically. Particle spectra data from PMS 1-D spectrometers were averaged for consecutive 20 sec periods. On each of the 3 days the particles having the smallest mean size were observed at the highest levels flown and had median diameters near 100 micrometers. The calculated equivalent liquid water content from 7 to 9 km was near 0.0 1 g cu m. The total particle count was between 8,000 and 18,000 cu m over Arkansas and coastal Delaware, but was near 25,000 cu m over the mountains of New Mexico. Values of mass and particle size increased with particle distance fallen, by indicating growth by collective means. The largest equivalent liquid water content values were near 1 g cu m and were recorded in the large snow just above the freezing level. The form factor, a mathematical parameter, was found useful in studying particle spectra. Certain maxima and minima observed in several plotted spectra, especially those from 7 km altitude data, are suggested as being due to an aggregation mechanism. GRA

N80-27965# National Hurricane and Experimental Meteorology Lab., Coral Gables, Fla.
NATIONAL HURRICANE AND EXPERIMENTAL METEOROLOGY LABORATORY, FISCAL YEAR 1979 Annual Report
Jan. 1980 59 p refs
(PB80-165228; NOAA-80022903) Avail: NTIS HC A04/MF A01 CSCL 04B

The National Hurricane and Experimental Meteorology Laboratory, Coral Gables, Florida, is NOAA's primary focus for research in tropical meteorology. Its two main areas of emphasis are: research on hurricanes and cumulus clouds related to improvement of the description, understanding, and prediction of these phenomena, and implementation of weather modification

experiments. This annual report for fiscal year 1979 presents the laboratory structure, personnel trends, research and related activies, and publications both in print and in preparation. GRA

N80-27966# Pennsylvania State Univ., University Park. Dept. of Meteorology.
SELECT RESEARCH GROUP IN AIR POLLUTION METEOROLOGY Final Report, May 1972 - Mar. 1978
R. A. Anthes, A. K. Blackadar, R. I. Kabel, J. L. Lumley, and H. Tennekes Feb. 1980 87 p refs
(Grant EPA-R-800297)
(PB80-166879; EPA-600/4-80-012) Avail: NTIS HC A05/MF A01 CSCL 04B

The development of a comprehensive mesoscale predictive transport model capable of nesting within a global scale grid system and sufficiently flexible in scale to be used for either regional or urban problems was identified as a central problem in air pollution meteorology. It was found that the treatment of the boundary was sufficiently general to permit application of the model to complex terrain problems. A variety of subsidiary one and two dimensional models for the prediction of mixed layer depth, nocturnal mixed layer evolution and buoyantly driven convection regimes was also developed. Work was also done on deposition processes and on facility development for measurements of air quality and model validation needs. GRA

N80-27967# Environmental Sciences Research Lab., Research Triangle Park, N.C. Meteorology and Assessment Div.
TURBULENT DIFFUSION FROM A POINT SOURCE IN STRATIFIED AND NEUTRAL FLOWS AROUND A THREE DIMENSIONAL HILL. PART 1: DIFFUSION EQUATION ANALYSIS
W. H. Synder (Cambridge Univ., England), J. C. R. Hunt (Atmospheric Environment Service, Downsview, Ontario), and J. S. Puttock 1979 14 p refs Submitted for publication
(PB80-163058; EPA-600/J-79-048) Avail: NTIS HC A02/MF A01 CSCL 04B

In stable stratified flow around three dimensional hills, vertical motion and vertical diffusion is negligible. Consequently turbulent diffusion from a point source can be modelled by considering horizontal flow and horizontal diffusion. Using an eddy diffusivity, the advective diffusive equation around a three dimensional hill which is axisymmetric about a vertical axis is solved to show how source positions on and off the center line affect the trajectories and splitting of impinging plumes and the value and position of the maximum surface concentration on the hill. A plume is analyzed in a neutrally stable potential flow around an axisymmetric obstacle such as a hemisphere, also using the diffusion equation. The solutions show how, because streamlines approach the surface of a 3 dimensional hill much more closely than the surface of a 2 dimensional hill, the maximum surface concentrations on the hill can become very much greater than in the absence of the hill. But this only occurs for a limited range of source heights. GRA

N80-27968# National Oceanic and Atmospheric Administration, Rockville, Md.
RED RIVER VALLEY TORNADOES OF APRIL 10, 1979. A REPORT TO THE ADMINISTRATOR Natural Disaster Survey Report
Jan. 1980 70 p ref Original contains color illustrations
(PB80-165210; NOAA-NDSR-80-1; NOAA-80030301) Avail: NTIS HC A04/MF A01 CSCL 04B

The three main storms in the Red River Valley outbreak were giant tornadoes. Each lasted for an hour or more and left a continuous track of ground damage 35 miles or longer. In addition, the damage path of all three was wider than normal. A NOAA disaster survey team was formed on April 11, 1979, to review the performance of the National Weather Service (NWS) and the National Environmental Satellite Service (NESS). The warning program, warning dissemination, disaster preparedness, and public response are discussed. GRA

N80-27969# National Weather Service, Silver Spring, Md. Meteorological Services Div.
PROBABILITY FORECASTING: REASONS, PROCEDURES, PROBLEMS
Lawrence A. Hughes Jan. 1980 96 p refs
(PB80-164353; NOAA-TM-NWS-FCST-24; NOAA-80022902) Avail: NTIS HC A05/MF A01 CSCL 04B

A comprehensive discussion of probability forecasting, based mainly on that for precipitation probability is presented to cover points of concern to those persons making probability forecasts. Points pertinent to those making management decisions concerning a probability program are included. Also included is a history of probability forecasting and an extensive set of references for those wanting more information. GRA

N80-27970# Oklahoma Univ., Norman. School of Meteorology.
PROVIDE AIRCRAFT OPERATION AND ANALYSIS FOR SESAME-79 Final Report
John McCarthy Dec. 1979 11 p
(Grant NA79RA-D-00016)
(PB80-165301) Avail: NTIS HC A02/MF A01 CSCL 04B

The University of Oklahoma provided personnel to support aircraft operations and analysis during SESAME-79. A summary of aircraft operations is given in tabular form. GRA

N80-27971# Purdue Univ., Lafayette, Ind. Dept. of Geosciences.
A FIELD INVESTIGATION OF ELECTRIC CURRENTS ASSOCIATED WITH SEVERE LOCAL STORMS Final Report
Christopher Church Oct. 1979 26 p refs
(Grant NA79RA-D-00014)
(PB80-165632; NOAA-80022205) Avail: NTIS HC A03/MF A01 CSCL 04B

Recent efforts to evaluate the nature and magnitude of point discharge currents during severe storms are described. During the early part of 1979 several corona current amplifiers were developed, and installed at surface mesonet stations in central Oklahoma, where they provided corona data during a major portion of SESAME-79. The results of the endeavor and details concerning instrumentation and operations are presented. GRA

N80-27972# Oklahoma Univ., Norman. School of Meteorology.
THE UNIVERSITY OF OKLAHOMA SEVERE STORMS INTERCEPT PROJECT-1979 Final Report, 15 Mar. - 31 Dec. 1979
Howard B. Bluestein Dec. 1979 46 p refs
(Grant NA79RA-D-00012)
(PB80-166010; NOAA-80022203) Avail: NTIS HC A03/MF A01 CSCL 04B

Ground-based visual observations in the wind field of thunderstorms observed simultaneously by Doppler radar were conducted from 1 April 1979-15 June 1979. Severe storm phenomena and related damage as well as tornadic debris clouds were photographed. Results and applications are discussed. GRA

N80-27734# World Meteorological Organization, Geneva (Switzerland).
CLIMATE AND CLIMATE MODELING Final Report
B. W. Boville *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 14-18 (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27738# Servizio Meteorologico dell'Aeronautica Militaire (Italy).
METEOROLOGICAL RESEARCH Final Report
B. Bizzarri *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 39-43 (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27739# Centre National de la Recherche Scientifique, Paris (France). Lab. de Meteorologie Dynamique.
SPACE TECHNIQUES Final Report
A. Berroir *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 44-48 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27742# Centre National de la Recherche Scientifique, Grenoble (France). Lab. de Glaciologie.
ICE SHEETS, GLACIERS, AND CLIMATE
L. Lliboutry *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. Res. (CHARM) from Space Feb. 1980 p 67-71 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27754# Zentralanstalt fuer Meteorologie und Geodynamik, Vienna (Austria).
MOUNTAIN OVERFLOW PHENOMENA IN SATELLITE IMAGERY
V. Zwatz-Meise *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 163-168 ref (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27755# Centre National de la Recherche Scientifique, Paris (France). Lab. de Meteorologie Dynamique.
METEOROLOGICAL RESEARCH AND CLOUD PARAMETER DERIVATION FROM SATELLITE DATA
M. Desbois and G. Szejwach *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 169-172 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27756# Servizio Meteorologico dell'Aeronautica Militaire (Italy).
METHODS AND PROBLEMS IN SATELLITE TEMPERATURE PROFILES AND WINDS
B. Bizzari *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1979 p 173-182 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27757# Centre National d'Etudes Spatiales, Paris (France). Paris Univ.
A VIEW ON OUTSTANDING EXPERIMENTAL PROBLEMS IN SPACE OBSERVATION FOR METEOROLOGY AND CLIMATOLOGY
P. Morel *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 185-188 Prepared jointly with Paris Univ. (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27758*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A MICROWAVE PRESSURE SOUNDER FOR THE REMOTE MEASUREMENT OF ATMOSPHERIC SURFACE PRESSURE
D. A. Flower and G. E. Peckham *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 189-192 refs Sponsored jointly with UK Science Research Council Prepared jointly with Heriot-Watt Univ., Edinburgh (For primary document see N80-27733 18-42)
(Contract NAS7-100)
Avail: NTIS HC A10/MF A01 CSCL 04B

N80-27759# University Coll., London (England). Dept. of Physics and Astronomy.
GLOBAL WIND DETERMINATION BY INTERFEROMETRIC TECHNIQUES IN THE TROPOSPHERE STRATOSPHERE AND MESOSPHERE
D. Rees *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 193-206 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-27973 Johns Hopkins Univ., Baltimore, Md.
PROPAGATION AND GENERATION OF INTERNAL TIDES ON THE CONTINENTAL MARGIN Ph.D. Thesis
Wen-Ssn Chuang 1980 126 p
Avail: Univ. Microfilms Order No. 8014265

The propagation of internal tide in the ocean is strongly affected by the effect of bottom topography and the effect of horizontal density stratification. In the particular case of a normal mode internal tide propagating into a region of linearly sloping, subcritical bottom plane and isopycnals, only the weak (discontinuous) solution can be constructed based upon the ray theory. It is shown that part of the incoming energy flux is induced upward along the characteristics at the sloping bottom and across the vertical line where the isopycnals change from level to upward inclination. Dissert. Abstr.

N80-27974 Florida State Univ., Tallahassee.
A MODEL OF A SUSPENDED SEDIMENT INDUCED, STABLY STRATIFIED OCEANIC BOTTOM BOUNDARY LAYER Ph.D. Thesis
Charles Earl Adams, Jr. 1980 77 p
Avail: Univ. Microfilms Order No. 8014108

A suspended sediment induced stably stratified oceanic bottom boundary layer is examined with a second moment turbulence closure model. The boundary layer momentum and mass conservation equations are coupled through the eddy diffusion coefficients for momentum and mass which are functions of the dependent variables of the problem. The bottom boundary layer BBL of the Florida current is modeled using observed geostrophic currents, bottom sediment size distribution and bottom roughness height as input parameters. Model results indicate that the boundary layer response to a suspended sediment concentration gradient is to reduce appreciably the level of turbulence and to modify significantly the velocity profile of the BBL. The turbulent kinetic energy and eddy conductivity are reduced by about 40% and 25% respectively and the bottom stress is reduced by approximately 45%. Dissert. Abstr.

N80-27975# Scripps Institution of Oceanography, La Jolla, Calif.
PROFILES OF VELOCITY AND TEMPERATURE NEAR THE INDIAN OCEAN EQUATOR, REVISION
R. A. Knox and M. J. McPhaden Mar. 1980 101 p refs
(Contracts N00014-75-C-0152; N00014-69-A-0200)
(AD-A083779; SIO-Ref-80-6-Rev) Avail: NTIS HC A06/MF A01 CSCL 08/3

Between January 1973 and May 1975, quasi-weekly vertical profiles of temperature and velocity were obtained near the equatorial island of Gan (00 deg 41 min S, 73 deg 10 min E) in the Central Indian Ocean. This report presents the profiles directly. One analysis of the data, treating the seasonal cycle of near-surface currents, has been published (Knox, 1976); others are in progress. GRA

N80-27976# Naval Postgraduate School, Monterey, Calif.
FIRST GENERATION NUMERICAL OCEAN PREDICTION MODELS: GOAL FOR THE 1980'S Progress Report, Oct. 1978 - Dec. 1979
Russell L. Elsberry and Roland W. Garwood, Jr. Dec. 1979 43 p refs
(AD-A083855; NPS63-79-007) Avail: NTIS HC A03/MF A01 CSCL 08/10

Using the experience of numerical weather prediction during the 1950's and 1960's as a model, a case is presented for development during the 1980's of an ocean prediction capability. Examples selected from recent research at the Naval Postgraduate School are used to illustrate some aspects of the theoretical background, representation of physical processes, observational-support systems and the justification for a first-generation ocean prediction system. GRA

N80-27977# National Marine Fisheries Service, Seattle, Wash.
BOTTOM-WATER TEMPERATURE TRENDS IN THE MIDDLE ATLANTIC BIGHT DURING SPRING AND AUTUMN, 1964-76
Clarence W. Davis Dec. 1979 21 p refs
(PB80-166200; NOAA-TR-NMFS-SSRF-739; NOAA-80012404) Avail: NTIS HC A02/MF A01 CSCL 08J

Annual variations of bottom-water temperatures on the continental shelf between Cape Cod and Cape Hatteras were examined for the spring and autumn from 1964 to 1976. Temperatures generally were highest since 1972 during both seasons. For waters between Cape Code and Hudson Canyon, maximum temperatures occurred in the spring of 1976 (8.3C) and autumn of 1972 (12.8C); between Cape Hatteras and Hudson Canyon, temperatures peaked in the spring of 1974 (9.0C) and the autumn of 1972 (15.7C). GRA

N80-27978# National Oceanic and Atmospheric Administration, Miami, Fla. Atlanta Oceanographic and Meteorological Labs.
PHYSICAL OCEANOGRAPHIC CONDITIONS AT A POTENTIAL OTEC SITE IN THE GULF OF MEXICO, 88 DEG W, 29 DEG N
Robert L. Molinari, Dennis Mayer, and Frank Chew Nov. 1979 160 p refs Sponsored in part by DOE, Washington, D.C.
(PB80-163710; NOAA-TM-ERL-AOML-41; NOAA-80020503) Avail: NTIS HC A08/MF A01 CSCL 08J

Physical oceanographic data were collected at the nominal position, 88 degrees W, 29 degrees N from July, 1977 through October, 1978. The position is some 150 km south of Mobile, Alabama and was occupied to obtain data needed in the OTEC design effort. Site occupations by research vessel and current meter deployments were used to obtain temperature, density and current data. GRA

N80-27747# Institute of Oceanographic Sciences, Wormley (England).
SPACE AND TIME SCALES OF OCEAN CIRCULATION
W. J. Gould *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 105-110 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27760# Cambridge Univ. (England). Dept. of Applied Mathematical and Theoretical Physics.
OCEAN CIRCULATION
D. L. T. Anderson *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 209-215 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-27979 California Univ., Berkeley.
TRANSIENT DIFFUSION IN MULTI-LAYER BIOLOGICAL TISSUE Ph.D. Thesis
Joseph Rasson 1979 126 p
Avail: Univ. Microfilms Order No. 8014852

The oxygen tension profile in the human cornea while a soft contact lens is in situ was investigated to answer some of the questions concerning the clinical application of soft contact lenses. A mathematical model of the cornea contact lens system was developed to predict the transient response of a Clark-type oxygen sensor pressed into the lens. Due to the lack of data on human corneal diffusion parameters, an analysis of the effect of different parameters on the oxygen tension profile was performed. The results indicate that the diffusion properties of corneal epithelium, specifically, its oxygen up-take rate and thickness, have dominant effects on oxygen tension under the lens. These findings could prove useful in determining which individuals can and cannot wear soft contact lenses. The diffusion property of the contact lens, its oxygen transmissibility, also has a significant effect on the oxygen tension under the lens. The agreement between the experimental results and the mathematical model indicates that the diffusion properties of the human cornea which exist in the literature are a reasonable estimation of actual normal diffusion parameters. Dissert. Abstr.

N80-27980 California Univ., Berkeley.
INSTRUMENTATION FOR THE MEASUREMENT OF VISCOSITY AND FLOW OF BIOLOGICAL FLUIDS Ph.D. Thesis
Lawrence Eugene Crooks 1979 223 p
Avail: Univ. Microfilms Order No. 8014642

Several ways to use nuclear magnetic resonance (NMR) to measure properties of fluids were investigated with emphasis on the measurement of fluid flow velocity. The technique also provided a measure of molecular self diffusion which was converted to the fluid's viscosity. The flow characteristic measured was a velocity distribution function which relates the fraction of fluid flowing to the fluid velocity. It is shown that a multiple pulse NMR sequence can be used to determine the velocity distribution. A self diffusion measurement gives the diffusion coefficient of a whole sample, whether it is stationary or flowing. It is also shown that varying the experiment timing, restricted diffusion can be observed and the size of biological miscelles can be estimated. The results of a study of diffusion in cervical mucus are presented. Results indicate that NMR relaxation time can also be used to determine the hemaglobin concentration in whole blood. Results of this type of measurement on leukemic whole blood and various blood fractions are presented.
Dissert. Abstr.

N80-27981*# National Aeronautics and Space Administration, Washington, D. C.
EXPERIMENTAL GASTRIC ULCERS INDUCED BY IMMOBILIZATION AND ELECTRIC SHOCK OF RATS AND THEIR PHARMACOTHERAPY
O. N. Zabrodin May 1980 7 p refs Transl. into ENGLISH from Farmakol. Toksikol. (USSR), v. 28, no. 6, 1965 p 717-719 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76157) Avail: NTIS HC A02/MF A01 CSCL 06C

The mechanism of development of experimental gastric ulcers, induced in rats by combined immobilization and electric shock, was analyzed pharmacologically with peripheral neurotropic agents. It is concluded that: (1) The most marked preventive effect in the development of the experimentally induced gastric ulcers was displayed by agents capable of blocking the ascending activation system of the reticular formation. (2) Sympathetic fibers, which disrupt the trophism of the gastric wall, form the efferent portion of the reflex arc. (3) Gastric secretion does not appear to be the primary cause of ulceration. R.E.S.

N80-27982*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF CENTRAL NEUROTROPIC SUBSTANCES ON THE HYPOPHYSISADRENAL CORTEX SYSTEM DURING IMMOBILIZATION OF ANIMALS
V. Ye. Ryzhenkov May 1980 9 p refs Transl. into ENGLISH from Farmakol. Toksikol. (USSR), v. 31, no. 5, 1968 p 545-548 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76158) Avail: NTIS HC A02/MF A01 CSCL 06C

The immobilization of guinea pigs for 5, 12, 24 and 48 hours, by securing to a slab, results in a persistent rise of the blood plasma 17-oxycorticosteroid concentration. Repeated administration of phenobarbital (50 mg/kg) and of the sodium salt of gamma-oxybutyric acid (500 mg/kg), as well as the combined administration of central m- and n-cholinolytics with small doses of phenobarbital tends to inhibit activation of the adrenal cortex during 48 hour immobilization of the animals. Repeated administration of aminazine (20 mg/kg) tends to decrease activation of the adrenal cortex. The administration of reserpine (0.1-5 mg/kg) 12-18 hours before immobilization of guinea pigs increases the response of the hypophysis-adrenal cortex system. Author

N80-27983*# National Aeronautics and Space Administration, Washington, D. C.
OXYGEN CONSUMPTION OF ANIMALS UNDER CONDITIONS OF HYPOKINESIA
Ye. N. Loginova, A. I. Volozhin, I. G. Krasnyku, and Ye. A. Stroganova May 1980 11 p refs Transl. into ENGLISH from Patrol. Fiziol. Eksp. Ter. (USSR), no. 4, Jul.-Aug. 1975 p 32-36 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original Doc. prepared by Med. Stomatological Inst., Moscow
(Contract NASw-3198)
(NASA-TM-76167) Avail: NTIS HC A02/MF A01 CSCL 06C

The influence of hypokinesia on the oxygen consumption of rats, dog, and squirrels was investigated. Three periods of gaseous exchange were revealed in rats under conditions of a limited motor activity. During the first 10-15 days O2 consumption displayed a sharp elevation; on the 20th-30th day, it became stabilized at a higher level (in comparison with control) and it sharply rose again on the 40th-100th day. In dogs, hypokinesia produced a reduction of O2 consumption and then a tendency to its elevation was seen. A short period of physical exercises in squirrels after hypokinesia led to increased oxygen consumption at rest. R.E.S.

N80-27984*# National Aeronautics and Space Administration, Washington, D. C.

MECHANISMS OF WATER-SALT METABOLISM DISTURBANCES IN DOGS SUBJECTED TO SIX MONTH HYPOKINESIA

V. I. Korolkov, Ye. A. Kovalenko, V. P. Krotov, N. A. Ilyushko, V. A. Kondratyeva, and Yu. I. Kondratyev May 1980 9 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 6, 1977 p 32-35 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-76170) Avail: NTIS HC A02/MF A01 CSCL 06C

Water-salt metabolism in dogs during prolonged restricted motor activity (hypokinesia) was investigated. It was found that hydration occurred and fluid was redistributed between the extra- and intra-cellular sectors. Also, electrolyte excretion rose, and magnetism and calcium metabolism changed significantly. It is concluded that the forces caused by muscle strain proper (which was decreased under conditions of hypokinesia) influence the state of bone metabolism. R.E.S.

N80-27985*# National Aeronautics and Space Administration, Washington, D. C.

BIOLOGICAL AND AERODYNAMIC PROBLEMS WITH THE FLIGHT OF ANIMALS

Erich V. Holst and Dietrich Kuchemann May 1980 37 p refs Transl. into ENGLISH from die Naturwissenschaften (Geottigen, West Germany), v. 24/25, 13 Jun. 1941 p 348-362 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-75337) Avail: NTIS HC A03/MF A01 CSCL 06C

Biological and aerodynamic considerations related to birds and insects are discussed. A wide field is open for comparative biological, physiological, and aerodynamic investigations. Considerable mathematics related to the flight of animals is presented, including 20 equations. The 15 figures included depict the design of bird and insect wings, diagrams of propulsion efficiency, thrust, lift, and angles of attack and photographs of flapping wing free flying wing only models which were built and flown. L.F.M.

N80-27986*# National Aeronautics and Space Administration, Washington, D. C.

THE GROWTH OF BIRDWINGS

K. Meunier May 1980 46 p refs Transl. into ENGLISH from Leipzig Abteilung, (East Germany), v. 161, no. 3-4, 1959 p 444-482 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by State Bird Protection Station, Schleswig-Holstein, West Germany

(Contract NASw-3199)

(NASA-TM-75821) Avail: NTIS HC A03/MF A01 CSCL 06C

Growth and order allometry is defined and applied to the growth of bird effects of negative wing allometry discussed with regard to body size and flight power. Transposition and evolutionary significance are explained. R.E.S.

N80-27987*# National Aeronautics and Space Administration, Washington, D. C.

EFFECT OF IMMOBILIZATION ON THE EEG OF THE BABOON. COMPARISON WITH TELEMETRY RESULTS FROM UNRESTRICTED ANIMALS

J. Bert and H. Collomb Apr. 1980 5 p refs Transl. into ENGLISH from Compt. Rend. Soc. Biol. (France) v. 159, no. 5, 1965 p 1202-1204 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(NASA-TM-76137) Avail: NTIS HC A02/MF A01 CSCL 06C

The EEG of the baboon was studied under two very different sets of conditions: 37 were totally immobolized while 12 were studied in their free movements with 4 channel telemetry. For the immobilized, 3 stages were described: (1) activation, record desynchronized; (2) rest with 13-15 cm/sec rhythm, like the human alpha rhythm stage but with eyes open or closed; (3) relaxation with a decrease in 13-15 rhythm and the appearance of 5-7 cm/sec theta waves, eyelids closed, animal apparently sleeping. For the free animals the rest stage appeared when the animal's attention was not directed anywhere and there was no relaxation stage. It is concluded that the EEG pattern of the immobilized animal that was described as the 'relaxation' stage really represents a special functional state which one must distinguish clearly from the physiological stages of sleep. R.E.S.

N80-27988*# National Aeronautics and Space Administration, Washington, D. C.

CALORIGENIC EFFECT OF ADRENALINE IN RATS UNDER CONDITIONS OF RESTRICTED MOTOR ACTIVITY

L. Tomaszewska, H. Kaciuba-Uscilko, and S. Kozlowski Jun. 1980 8 p refs Transl. into ENGLISH from Artif. Satell. (Poland), 1/2, 1973 p 75-80 Presented at Symp. on Cosmic Biol. and Med., Warsaw, 12-17 Jun. 1972. Translation was announced as A74-20558 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-76192) Avail: NTIS HC A02/MF A01 CSCL 06C

In previous studies, it was demonstrated that long term restricted motor activity in rats induces a decrease in body weight, an increase in release of adrenaline, and a decrease in the release of noradrenaline with the urine, as well as a reduction in activity of the thymus gland and level of thyroxin in the blood. At the same time, a decrease was found in the internal body temperature that was accompanied by an increase in the rate of metabolism in the state of rest. An investigation is presented which attempts to clarify whether the calorigenic effect of adrenaline under conditions of increased metabolism in the period of immobility is exposed to changes. R.E.S.

N80-27989*# National Aeronautics and Space Administration, Washington, D. C.

DISPLACEMENT OF PLASMA PROTEIN AND CONDUCTION VELOCITY IN RATS UNDER ACTION OF ACCELERATION FORCES AND HYPOKINESIA

S. Baranski, Z. Edelwejn, and M. Wojtkowiak Jun. 1980 10 p refs Transl. into ENGLISH from Postepy Astronautyki (Poland), v. 5, no. 2, 1972 p 61-70 Original language document annouced as A73-17769 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Military Academy of Aviation Medicine, Warsaw

(NASA-TM-76195) Avail: NTIS HC A02/MF A01 CSCL 06C

The permeability of capillary vessels was investigated in order to determine if acceleration alone or following prolonged hypokinesia would induce changes in the vascular wall leading to the penetration by I-albumins and/or proteins with larger molecules. In rats undergoing action of +5 Gz accelerations, no increase in vascular permeability, as tested with the use of (Cr-5k)-globulin, was demostrated. In rats immobilized for 4 weeks before centrifugation, rather weak migration of (Cr-51)-globulin from the vessels was observed. Immobilization resulted also in lowering of conduction velocity in the sciatic nerve. R.E.S.

N80-27990*# National Aeronautics and Space Administration, Washington, D. C.

EXPERIMENTAL CORONARY SCLEROSIS INDUCED BY IMMOBILIZATION OF RABBITS: A NEW MODEL OF ARTERIOSCLEROSIS

V. V. Tyavokin and W. W. Tjawokin Jun. 1980 19 p refs Transl. into ENGLISH from Virchows Arch., A. (West Germany), v. 346, 1969 p 29-45 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3198)

(NASA-TM-76196) Avail: NTIS HC A02/MF A01 CSCL 06C

A new method for producing arteriosclerosis with coronary insufficiency in rabbits by means of immobilization is described and discussed. The experimentally induced atherosclerosis develops due to hypodynamics imposed by the reduced muscular activity without overloading with exogenous cholesterol. The atherosclerosis and coronary insufficiency are associated. With variations in the duration and extent of immobilization, coronary insufficiency alone or with atherosclerosis can be produced. R.E.S.

N80-27991*# National Aeronautics and Space Administration, Washington, D. C.

EFFECT OF PSYCHOTROPIC DRUGS ON GASTRIC ULCERS INDUCED BY IMMOBILIZATION: INCREASED PROTECTIVE EFFECT OF AMITRIPTYLINE CAUSED BY CHLORDIAZEPOXIDE

J. E. Blum and A. Huerlimann Jun. 1980 6 p refs Transl. into ENGLISH from Med. Pharmacol. Exp. (Switzerland), v. 15, no. 6, 1966 p 615-617 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by F. Hoffmann-La Roche and Co., Basel, Switzerland

(Contract NASw-3199)

(NASA-TM-76197) Avail: NTIS HC A02/MF A01 CSCL 06C

Amitriptyline, but not chlordiazepoxide, protects rats from the occurrence of gastric erosions and ulcers following immobilization. When, however, chlordiazepoxide is given together with amitriptyline the protective effect of the latter is markedly increased. Author

N80-27992*# National Aeronautics and Space Administration, Washington, D. C.

EFFECTS OF HYPODYNAMIA ON THE HEMOCOAGULATIVE PROPERTIES OF THE VASCULAR WALL AND MYOCARDIUM

V. I. Inchina Jun. 1980 9 p refs Transl. into ENGLISH from Kardiologiya (USSR),v. 18, no. 3, Mar 1978, p 126-129 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(NASA-TM-76199) Avail: NTIS HC A02/MF A01 CSCL 06C

The hemocoagulative properties of the aorta (laminar), myocardium, hollow veins, and fibrinolytic capacity of tissues were studied in 14 rabbits subjected to 7 days of restricted mobility and compared to those of 10 control animals. Two tables of results show that, as a result of hypodynamia, the thromboplastic activity of the inner and middle layers of the aorta together with the destruction of endothelium increases the hemocoagulative potential and creates the threat of thrombogenesis. There is also an increase in fibrin-stabilizing activity for all tissues. Author

N80-27993*# National Aeronautics and Space Administration, Washington, D. C.

EFFECTS OF IMMOBILIZATION ON SPERMIOGENESIS

E. R. Meitner 30 Jul. 1980 14 p refs Transl. into ENGLISH from Acta Anat. (Switzerland), no. 95, 1976 p 300-308 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Comenius Univ. of Bratislava, Czecholovakia

(Contract NASw-3199)

(NASA-TM-76282) Avail: NTIS HC A02/MF A01 CSCL 06C

The influence of immobilization stress on spermiogenesis in rats was investigated. After 96 hour immobilization, histological changes began to manifest themselves in the form of practically complete disappearance of cell population of the wall of seminiferous tubule as well as a markedly increased number of cells with pathologic mitoses. Enzymological investigations showed various changes of activity (of acid and alkaline phosphatase and nonspecific esterase) in the 24, 48, and 96 hour immobilization groups. R.E.S.

N80-27994# Joint Publications Research Service, Arlington, Va.

USSR REPORT: SPACE BIOLOGY AND AEROSPACE MEDICINE, VOLUME 14, NO. 3, 1980

27 Jun. 1980 158 p refs Transl. into ENGLISH of Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 158 p (JPRS-75956) Avail: NTIS HC A08/MF A01

The effects of prolonged exposure to space flight factors are examined. Hemodynamic responses, physiological effects, biological effects as well as the effects of reduced motor activity and weightlessness are considered. Results of ground-based and spaceborne experiments on various laboratory animals are included. For individual titles, see N80-27995 through N80-28014.

N80-27995# Joint Publications Research Service, Arlington, Va.

BIOCHEMICAL BASES OF PATHOGENESIS OF HYPOKINESIA c54

I. V. Fedorov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 1-12 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 3-10 (For primary document see N80-27994 18-51)

Avail: NTIS HC A08/MF A01

An attempt to gain an insight into pathogenetic mechanisms and sequence of reactions responsible for changes in the metabolism of proteins, carbohydrates, and fats of hypokinetic animals is described. J.M.S.

N80-27996# Joint Publications Research Service, Arlington, Va.

RESULTS OF STUDIES OF PULSED BLOOD FLOW AND REGIONAL VASCULAR TONUS DURING FLIGHTS IN THE FIRST AND SECOND EXPEDITIONS ABOARD THE SALYUT-6-SOYUZ ORBITAL COMPLEX c52

V. F. Turchaninova and M. V. Domracheva *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 13-18 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 11-14 (For primary document see N80-27994 18-51)

Avail: NTIS HC A08/MF A01

The dynamics of pulse blood filling and regional vascular tone was studied in the crewmembers of 96 and 140 day flights aboard the station Salyut-6 - Soyuz. Measurements were taken before, during and after flights, using a specially designed tetrapolar rheography. Rheograms of the torso, forearms, legs, and rheoencephalograms of the right and left hemispheres in the frontal-mastnidal lead were recorded. The results show that in zero-g the cosmonauts developed typical hemodynamic changes indicative of cephalad blood shifts. Author

N80-27997# Joint Publications Research Service, Arlington, Va.

CIRCULATION IN EXERCISING CREW MEMBERS OF THE FIRST MAIN EXPEDITION ABOARD SALYUT-6 c52

V. S. Georgiyevskiy, N. A. Lapshina, L. Ya. Andriyako, L. C. Umnova, V. G. Doroshev, I. V. Alferova, V. N. Ragozin, and Ye. A. Kobzev *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 19-23 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 15-18 (For primary document see N80-27994 18-51)

Avail: NTIS HC A08/MF A01

During the 96 day flight aboard the Salyut-6 station the crewmembers showed a satisfactory response to bicycle ergometry of moderate load. However, cardiovascular regulation during exercise declined, particularly by the end of the first and the begining of the second month. This was mainly associated with deconditioning due to an inadequate work load. Its increase helped to restore an initial level of circulation during exercise by the end of the mission. Author

N80-27998# Joint Publications Research Service, Arlington, Va.

HEMODYNAMICS AND PHASE STRUCTURE OF THE CARDIAC CYCLE IN MEMBERS OF THE FIRST CREW OF SALYUT-5 AT REST c52

V. A. Degtyarev, V. G. Doroshev, N. A. Lapshina, V. N. Ragozin, Z. A. Kirillova, S. I. Ponamarev, and O. B. Kulikov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 24-28 refs Transl. into

ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 18-21 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

In the Salyut-5 flight studies of circulatory functions were continued. Heart rate, arterial pressure, time intervals of the left and right ventricles were measured at rest. Peripheral resistance and cardiac output were calculated. At early flight stages cardiovascular changes occurred due to an increased blood inflow to the heart. During the second half of the mission cardiac output and arterial pressure remained elevated, as fatigue of the cosmonauts increased. Author

N80-27999# Joint Publications Research Service, Arlington, Va.
EFFECT OF WEIGHTLESSNESS AND ARTIFICIAL GRAVITY ON ION-REGULATING FUNCTION OF RAT KIDNEYS
Ye. A. Ilin, Yu. V. Natochin, N. A. Ilyushko, Yu. I. Kondratyev, V. T. Bakhteyeva, Ye. M. Gazhala, O. A. Gomcharevskaya, Ye. A. Lavrova, and Ye. I. Shakhmatova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 29-34 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 21-25 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

Weightless rats showed greater changes in the fluid-electrolyte metabolism and ion regulatory function of the kidneys than centrifuged rats. During water loads they exhibited an increased sodium excretion. During potassium loads they displayed a higher potassium excretion. The study of electrolyte composition of different kidney segments demonstrated a reduced potassium content in the wet cortical and medullary matter due to elevated tissue hydration. Kidney microdissection did not reveal any structural differences in nephrons of the weightless and centrifuged rats. Author

N80-28000# Joint Publications Research Service, Arlington, Va.
ACTIVITY OF SOME HEPATIC ENZYMES AND LIPOGENETIC PROCESSES IN RAT AIPOSE TISSUE AFTER SPACE FLIGHT
L. Makho, Sh. Nemet, M. Palkovich, V. Shtrbak, and R. A. Tigranyan *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 35-40 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 26-29 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

The rats flown aboard Cosmos-782 showed a significant increase in the activity of tyrosine aminotransferase and tryptophan pyrolase, i.e., the enzymes whose activity depends on the corticosterone level. The synchronous rats displayed a small increase in the enzyme activity. The flight and synchronous animals exhibited a slight increase in the activity of gluconeogenetic enzymes and a decrease in the activity of glucose-6-phosphatase. Immediately after flight and, to a lesser extent, after the synchronous experiment the activity of lipogenetic enzymes decreased. On the R+25 day the enzyme activity remained unchanged. The study of lipogenesis in the epididymal fat, using C14-glucose incorporation into lipids, did not reveal any differences in the flight and synchronous rats. The findings demonstrated that changes in the enzyme activity induced by the flight and synchronous experiments returned to the normal during readaptation. Author

N80-28001# Joint Publications Research Service, Arlington, Va.
STATE OF RAT THYROID C CELLS FOLLOWING FLIGHTS ON THE COSMOS TYPE OF BIOSATELLITES (ACCORDING TO RESULTS OF A MORPHOLOGICAL STUDY)
G. I. Plakhuta-Plakutina *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 41-46 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 29-33 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

Calcitonin-secreting cells (C-cells) of the thyroid glands from 51 SPF Wistar rats flown for 18.5 to 22 days aboard biosatellites Cosmos-605, 782 and 936 and sacrificed 4.5-13 hours, 1-2 and 25-27 days after recovery were examined histologically and karyometrically. Vivarium (57) and synchronous (58) rats were used as controls. Variations in the nuclear volume of C-cells and their density were shown to depend on the experimental conditions and time interval elapsed after recovery. Morphological changes in C-calls were assumed to be associated with alterations in calcium metabolism during an exposure of rats to weightlessness, artificial gravity, and Earth gravity. Author

N80-28002# Joint Publications Research Service, Arlington, Va.
SOME ASPECTS OF APPLICATION OF THE SYSTEMIC APPROACH TO AVIATION ENGINEERING PSYCHOLOGY c53
V. A. Ponomarenko and N. D. Zavalova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 47-52 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 33-37 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

The role of study and analysis of systemic properties of the equipment of cockpits for its optimization is examined. Pilot's errors caused by disadvantages of the total systemic quality of various components of the equipment are described. Methods for eliminating causes of some erroneous actions of pilots are discussed. J.M.S.

N80-28003# Joint Publications Research Service, Arlington, Va.
EFFECT OF PROLONGED +Gz ACCELERATIONS ON HUMAN PERFORMANCE c53
A. S. Barer, T. A. Sokolova, V. M. Tardov, and Yu. P. Yashin *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 53-59 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 37-40 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

With an increase in acceleration value, the accuracy of human performance decreases. This becomes very noticeable at $+Gz > 5$ g. In this situation work capacity can be raised by increasing an angle between the Gz vector and the long axis of the human body. Pilots need to be tested for acceleration clearance before they are allowed to fly at $+Gz >$ or $= 8$ g. Author

N80-28004# Joint Publications Research Service, Arlington, Va.
HUMAN COLOR DISCRIMINATING FUNCTION WITH MUSCULAR TENSION DURING EXPOSURE TO VESTIBULAR STIMULI c52
Zh. M. Kudryashova and A. A. Shipov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 60-64 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 41-44 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

Human studies have demonstrated that arbitrary tension of muscle (back and legs) during repeated vestibular exposures not only delays the development of motion sickness but also contributes to the maintenance of color discriminative stability of the visual function. Author

N80-28005# Joint Publications Research Service, Arlington, Va.
EFFECT OF TRANSVERSE ACCELERATIONS ON INNERVATION OF THE GUINEA PIG'S CRURAL SKELETAL MUSCLES
V. Ya. Osaulenko *In its* USSR Rept.: Sapce Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 65-71 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 44-48 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

Guinea pigs were exposed to chest-to-back acceleration of 8 G for an hour. This exposure brought about significant

morphological changes of a primary-reactive pattern in nerve elements of skeletal leg muscles. With time they enhanced: 6 hours and then 3 days after the experiment a small portion (1-1.5%) of nerve fibers underwent fragmentation and degradation. Motor nerve endings showed the highest resistance. The first signs of restitution of changes in the peripheral nervous system were seen 6 days after the exposure. Nerve fibers did not return to the normal 9 days after the beginning of the experiment.
Author

N80-28008# Joint Publications Research Service, Arlington, Va.
STUDIES OF PROGNOSTIC SIsignificance OF ANTIORTHOSTATIC POSITION c52
Kh. Kh. Yarullin, V. A. Gornago, T. D. Vasilyeva, and M. Ye. Gugushvili *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 72-80 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 48-54 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

The prognostic significance of head-down tilt at -15 deg and -30 deg for 6 min at each step was assessed in 40 normal men, aged 22 to 39. The study of mean values of the maximal amplitude, relative duration of the anacrotic phase, dicrotic, and diastolic indices of hemispheric and bimastoidal rheoencephalography as well as of health condition helped to determine cerebral circulation in test subjects with good and moderate tolerance to head-down tilt and to define the criteria of tilt tolerance. The test subjects who showed good tolerance to head-down tilt displayed a simultaneous compensatory increase of the tone of large caliber arteries and arterioles that was accompanied by a noticeable increase in cerebral pulse blood filling at -15 deg and a moderate increase at -30 deg as well as the feeling of a slight blood rush to the head. The test subjects who displayed moderate tolerance to heat-down tilt showed only an increase in the tone of large caliber vessels; they also exhibited a marked decrease in the tone of arterioles, venules, and veins (especially at -30 deg) which was combined with a significant increase in the cerebral pulse blood filing and an appearance of marked venous waves on rheoencephalograms.
Author

N80-28007# Joint Publications Research Service, Arlington, Va.
EVALUATION OF EFFICACY OF THE SET OF PREVENTIVE MEASURES REFERABLE TO THE HUMAN NEUROMUSCULAR SYSTEM UNDER HYPOKINETIC CONDITIONS c52
V. A. Tishler, V. 1. Safonov, and Z. A. Krivitsina *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 81-85 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), no. 3, 1980 p 54-57 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

Excitability and lability of the musculus rectus femoris was studied to evaluate efficiency of exercises during bed rest. A combination of exercises with other countermeasures did not reduce their prophylactic effect.
A.M.S.

N80-28008# Joint Publications Research Service, Arlington, Va.
THE STRESS REACTION TO HYPOKINESIA AND ITS EFFECT ON GENERAL RESISTANCE c52
I. P. Chernov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 86-90 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 57-60 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

Rat experiments demonstrated that the development of the hypokinetic syndrome involves occurrence of a three stage, stress reaction characterized by a change in the general health state, body mass, and activity of the hypothalamic-pituitary-adrenal system. The hypokinetic stress affects total resistance and ionizing radiation sensitivity of animals. At a certain stage of development the hypokinetic stress contributes to the state of elevated cross resistance.
J.M.S.

N80-28009# Joint Publications Research Service, Arlington, Va.
REGIONAL REDISTRIBUTION OF RAT BLOOD AFTER 7 AND 30 DAYS OF HYPOKINESIA
O. A. Kovalev, V. F. Lysak, V. I. Severovostokova, and S. K. Sheremetevskaya *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 91-96 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 60-64 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

An exposure of rats to hypokinesia was accompanied by a significant increase in the total amount of circulating blood per unit body mass. The percentage blood content was increased in the myocardium, lungs, liver, kidneys, small intestine, muscles and bones of the chest. The percentage blood content was decreased in the skin of different body segments, muscles and bones (except of the chest), tail, viscera (large intestine, adrenals, spleen, bladder, testes). The major regional redistribution of blood was its displacement into the liver.
Author

N80-28010# Joint Publications Research Service, Arlington, Va.
SECRETION, INCRETION AND RESECRETION OF PANCREATIC LIPASE DURING PROLONGED RESTRICTION OF MOTOR ACTIVITY c52
I. L. Medkova, N. M. Nikolayeva, and K. V. Smirnov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 97-103 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 64-67 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

The effect of 20, 60, 90 and 120 day hypokinesia on secretion, incretion, and recretion of pancreatic lipase of rats was examined. It was found that 60, 90 and 120 day hypokinesia induced significant and similar changes - lipase decrease in the pancreas and increase in blood, bile, salivary glands and stomach mucosa; 20 day hypokinesia did not produce any effect on the above parameters.
Author

N80-28011# Joint Publications Research Service, Arlington, Va.
THEORETICAL ANALYSIS OF THE EFFECT OF STATE OF PULMONARY CIRCULATION ON DISTRIBUTION OF VENTILATION-PERFUSION RELATIONS AND GAS EXCHANGE IN THE LUNGS c52
A. I. Dyachenko and V. G. Shabelnikov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 104-109 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 68-71 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

Using a mathematical model of functionally nonuniform lungs, the effect of gravational inequality of ventilation perfusion relations on gas exchange was studied. The dependence of tensions of respiratory gases in the mixed arterial blood and alveolar air upon pulmonary circulation pressure was demonstrated. The influence of changes in the tone of lung vessels on the distribution of ventilation perfusion relations and gas exchange was investigated.
Author

N80-28012# Joint Publications Research Service, Arlington, Va.
METHOD FOR ASSESSING HEMODYNAMICS AND DETECTING LATENT INSUFFICIENCY OF CEREBRAL CIRCULATION IN COSMONAUT CANDIDATES c52
D. A. Alekseyev *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 110-116 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 71-74 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

Experience in screening cosmonaut candidates shows that many of them present osteochondrosis of the cervical spine. In some of the selected individuals, the signs of intervertebral osteochondrosis are progressing. Osteophytes in this region

sometimes cause ischemic circulatory disturbances in the vertebrobasilar system as a result of reflex angiospasm of vertebral arteries and mechanical compression of the latter. For this reason, it is very important to assess blood flow in the systems of the vertebral arteries (basilar and internal carotid) and determine the functional capabilities of collaterals and latent circulatory disturbances in the corresponding vascular reservoirs. A functional test used for this purpose, involving rotation of the head and throwing it back to an angle of 45 deg is described. J.M.S.

N80-28013# Joint Publications Research Service, Arlington, Va.

ULTRASONIC METHOD OF RECORDING GAS BUBBLES IN ANIMAL VENOUS BLOOD IN A RAREFIED ATMOSPHERE c52

R. T. Kazakova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 117-121 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 74-76 (For primary document see N80-27994 18-51)

Avail: NTIS HC A08/MF A01

A method of recording [demonstrating] intravascular gas bubbles, which appear under the influence of decompression due to elevated pressure, with the use of ultrasonic equipment is described. The possibility of using the ultrasonic method to study the process of gas production in animals and man in a rarefied atmosphere is demonstrated. This method can be used in the system for monitoring the physiological condition of man at high altitudes. J.M.S.

N80-28014# Joint Publications Research Service, Arlington, Va.

ISOLATION AND GAS CHROMATOGRAPHIC DEMONSTRATION OF VOLATILE ORGANIC SUBSTANCES IN THIN-LAYER BIOLOGICAL SAMPLES

N. F. Sopikov and A. I. Gorshunova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 122-127 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 77-79 (For primary document see N80-27994 18-51)

Avail: NTIS HC A08/MF A01

Gas chromatographic methods are used to demonstrate organic compounds in studies of the effects of space flight factors and conditions (for example, hypokinesia, radiation, hypoxia, etc.) on processes of accumulation, distribution and elimination of volatile chemicals from the human and animal organism. A simple and rapid method was developed for isolating volatile organic substances from biological media and tissues to be submitted to gas chromatographic analysis. This method was based on the principle of direct thermal evaporation of volatile compounds from thin layer biological samples, obtained by using a pyrolytic attachment with the chromatograph. J.M.S.

N80-28015# Joint Publications Research Service, Arlington, Va.

USSR REPORT. SPACE BIOLOGY AND AEROSPACE MEDICINE, VOLUME 14, NO. 2, 1980

O. G. Gazenko, ed. 8 May 1980 157 p refs Transl. into ENGLISH of Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 157 p

(JPRS-75654) Avail: NTIS HC A08/MF A01

The biological and physiological effects of long term space flight are examined. Hyperbaric conditions, hypokinesia, weightlessness, hypoxia, and hypercapnia are among the support systems are included. For individual titles, see N80-28016 through N80-28036.

N80-28016# Joint Publications Research Service, Arlington, Va.

RESPIRATION AND GAS EXCHANGE UNDER HYPERBARIC CONDITIONS c52

L. A. Bryantseva, I. S. Breslav, and A. G. Dianov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 1-14 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 3-10 (For primary document see N80-28015 18-51)

Avail: NTIS HC A08/MF A01

The effects of hyperbaric environments on respiratory function are discussed. Respiratory mechanics, pulmonary ventilation, and oxygen and carbon dioxide transport are included. Particular attention is given to the respiratory system as a limiting factor for human performance in a hyperbaric environment. Optimization of gas mixtures used in undersea dives is discussed. J.M.S.

N80-28017# Joint Publications Research Service, Arlington, Va.

CIRCULATION AT REST IN CREW MEMBERS OF THE FIRST MAIN EXPEDITION ABOARD SALYUT 6 c52

V. A. Degtyarev, V. G. Doroshev, V. M. Mikhaylov, V. S. Georgiyevskiy, S. A. Kobzev, Z. A. Kirillova, N. A. Lapshina, V. G. Savelyeva, and L. V. Umnova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 15-19 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 11-14 (For primary document see N80-28015 18-51)

Avail: NTIS HC A08/MF A01

Results of in-depth medical examinations of crew members who participated in the first expedition involving a 96 day space flight aboard the Salyut-6 orbital station are presented. Distinct variations of certain cardiovascular parameters exhibited an early stage, later returned to the normal. These changes are characteristics of individual processes of human adaptation to weightlessness. J.M.S.

N80-28018# Joint Publications Research Service, Arlington, Va.

STATE OF HUMAN BONE TISSUE PROTEIN FRACTION AFTER SPACE FLIGHTS c52

A. A. Prokhonchukov, V. K. Leontyev, N. A. Zhizhina, R. A. Tigranyan, A. G. Kolesnik, and N. A. Komissarova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JRPS-75654) 8 May 1980 p 20-26 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 14-18 (For primary document see N80-28015 18-51)

Avail: NTIS HC A08/MF A01

Amino acid composition and bone mineralization were studied qualitatively and qualititatively on autopsy of the three crewmembers after their 28 day space flight aboard the orbital station Salyut 1. Sixteen amino acids were detected in the bone protein fraction: cystine and cysteine, lysine histidine, arginine, aspartic acid, serine, glycine, glutamic acid, threonine, alanine, proline, valine, phenylalanine, leucine and isolcusine, oxyproline. No abnormalities in the amino acid composition or the bone organic content were found in the postflight analysis. The role of protein matrices of calcified tissues in mechanisms of bone resistance and adaptation to space flight effects is discussed. J.M.S.

N80-28019# Joint Publications Research Service, Arlington, Va.

RESEARCH HARDWARE AND HABITAT OF ANIMALS USED IN EXPERIMENT ABOARD COSMOS-936 BIOSATELLITE

B. A. Adamovich, Ye. A. Ilin, A. D. Noskin, V. I. Milyavskiy, G. N. Pliskovskaya, V. K. Golov, V. S. Poleshchuk, V. K. Ovcharov, and A. A. Shipov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 27-32 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 18-22 (For primary document see N80-28015 18-51)

Avail: NTIS HC A08/MF A01

The hardware used to provide the support to experimental animals (rats) and to obtain information in-flight is described. The hardware includes two specially designed centrifuges to generate artificial gravity. The environmental parameters in the mock-up cabin and field laboratories used at the recovery site are also described. J.M.S.

N80-28020# Joint Publications Research Service, Arlington, Va.

PRINCIPAL RESULTS OF PHYSIOLOGICAL EXPERIMENTS WITH MAMMALS ABOARD THE COSMOS-936 BIOSATELLITE

O. G. Gazenko, Ye. A. Ilin, A. M. Genin, A. R. Kotovskaya, V. I. Korolkov, R. A. Tigranyan, and V. V. Portugalov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 33-37 refs Transl. into ENGLISH

from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 22-25 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

The program of the 18.5 day flight of the biosatellite Cosmos-936 included studies of physiological effects of prolonged weightlessness (20 rats) and artificial gravity (10 rats). The latter produced a normalizing effect on the function of the myocardium, musculo-skeletal system, and excretory system. Simultaneously, artificial gravity exerted an adverse effect on the functions dependent on several sensors, primarily optic, vestibular, and motor sensors. It is postulated that the adverse effects are associated with a relatively high rate of rotation and a short arm of the centrifuge. Author

N80-28021# Joint Publications Research Service, Arlington, Va.
SEMICIRCULAR CANAL FUNCTION IN RATS AFTER FLIGHT ABOARD THE COSMOS-936 BIOSATELLITE
A. A. Shipov and V. G. Ovechkin *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 38-44 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 25-30 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

The nystagmic reflex, latent period, total and mean number of events, and their duration were measured in the rats flown for 18.5 days aboard the biosatellite Cosmos-936 under the conditions of weightlessness and artificial gravity. It is demonstrated that prolonged weightlessness did not influence the receptor formations and centers of semicircular canals. A long exposure to artificial gravity brought about a decrease in reactivity and sensitivity of semicircular canals. The mechanisms of these phenomena are discussed. J.M.S.

N80-28022# Joint Publications Research Service, Arlington, Va.
ROLE OF DYNAMIC SPACE FLIGHT FACTORS IN THE PATHOGENESIS OF INVOLUTION OF LYMPHATIC ORGANS (EXPERIMENTAL MORPHOLOGICAL STUDY)
A. S. Kaplanskiy and G. N. Durnova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 45-52 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 30-35 (For primary document see N80-28015 18-51)
Avail: NTIS HC A02/MF A01

The role of the dynamic factors in accidental involution of lymph organs was investigated in a ground based study simulating a 20 day space flight. It is inferred from the study that lymph organ involution observed in rats exposed to prolonged space flights is caused by chronic and acute stresses. Chronic stress is associated with weightlessness and leads to hypoplasia of lymphs organs; acute stress is connected with the transition from weightlessness to normal gravity (gravity stress), thus enhancing chronic stress induced lymph tissue hypoplasia. Spleens of both weightless and hypokinetic rats slow inhibition of crythropoiesis and accumulation of hemosiderine due to accelerated erythrocyte degradation caused by diminished motor activity. J.M.S.

N80-28023# Joint Publications Research Service, Arlington, Va.
EFFECT OF HIGH AMBIENT TEMPERATURE ON HUMAN PERFORMANCE c53
A. N. Azhayev, V. I. Zorile, and A. N. Koltsov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 53-57 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 20 Mar./Apr. 1980 p 35-38 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

Mental and physical capacity of men exposed to 30 to 35 deg at low humidity and to 25 to 30 deg at high humidity remained unaltered. The capacity of men exposed to 40 to 55 C at 10 to 25% of relative humidity and to 35 to 40 C at 85% of relative humidity declined. Author

N80-28024# Joint Publications Research Service, Arlington, Va.
DYNAMICS OF HUMAN EXTERNAL RESPIRATION AND BLOOD GASES UNDER THE COMBINED EFFECT OF HYPERCAPNIA AND HYPOXIA c52
L. Kh. Bragin, A. Ya. Severin, N. A. Agadzhanyan, G. A. Davydov, and Yu. A. Spasskiy *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 58-62 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 38-41 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

In manned experiments gas mixtures with a step-by-step increasing (p)CO2 and hypoxia of different levels were used. The experiments demonstrated variations in respiration, buffer systems, and gases of the blood. The studies emphasized an important physiological role of a constant (p)CO2 in blood, when breathing gas mixtures with a different O2 content. Author

N80-28025# Joint Publications Research Service, Arlington, Va.
FUNCTIONAL STATE OF THE CARDIOVASCULAR SYSTEM UNDER THE COMBINED EFFECT OF 28 DAY IMMERSION, ROTATION ON A SHORT-ARM CENTRIFUGE AND EXERCISE ON A BICYCLE ERGOMETER c52
I. F. Vil-Vilyams and Ye. B. Shulzhenko *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 63-68 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 42-45 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

The cardiovascular function of four test subjects exposed to 28 day dry immersion was examined before and after 6 day cycles of rotation in a short-arm centrifuge to provide 1 to 2 Gz, bicycle ergometer exercise, and their combination. An exposure to acceleration of 3 Gz in a 7.25 m arm centrifuge was used as a provocative test. The above countermeasures reduced but not climinated entirely immersion-induced cardiovascular deconditioning. A combined use of acceleration of 1 to 2 Gz in a short-arm centrifuge and bicycle ergometer exercise can be recommended as a countermeasure against cardiovascular deconditioning in weightlessness. J.M.S.

N80-28026# Joint Publications Research Service, Arlington, Va.
PHARMACOLOGICAL ANALYSIS OF PHYSIOLOGICAL MECHANISMS OF ORTHOSTATIC HEMODYNAMIC STABILITY c52
L. I. Osadchiy *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 69-74 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 45-49 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

In urethane anesthesized cats, securinine brought about a distinct increase in compensatory reactions of arterial pressure and cardiac output during an upright tilt at 45 deg. The experiments also showed a substantial increase in compensatory recovery of the volume velocity of circulation in the posterior vena cava. Myorelaxant induced arrest of contractile function of skeletal muscles prior to securinine administration reversed compensatory reactions of arterial pressure and cardiac output during tilt test. Author

N80-28027# Joint Publications Research Service, Arlington, Va.
BIOELECTRIC ACTIVITY OF THE HUMAN BRAIN DURING AND AFTER 182-DAY ANITORTHOSATIC HYPOKINESIA c52
T. N. Krupina, Kh. Kh. Yarullin, and D. A. Alekseyev *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 75-83 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 49-54 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

Cerebral bioelectric activity of 18 healthy test subjects, aged 31 to 40, was examined during and after their 182 day head-down tilting. The test subjects were divided into a group that performed countermeasures (exercise, muscle stimulation) against hypokinesia-induced disorders and a control group. During

the study EEG changes were most pronounced in the controls: alpha-rhythm amplitude, frequency, and index decreased; slow wave frequency reduced; index of zonal differences and amplitude beta and slow waves increased. Phasic changes in the central nervous system excitability in response to a flickering light of 6 to 25 cps were found. Typical changes in spontaneous EEG during a 3 min pulmonary hyperventilation test were enhanced. The study gives evidence that the dynamics of spontaneous EEG as well as cerebral bioelectric activity in response to flickering light and pulmonary hyperventilation are important indicators of the cerebral function, especially of the cortical activity decrease.
Author

N80-28028# Joint Publications Research Service, Arlington, Va.
MORPHOMETRIC ANALYSIS OF GLOMERULES AND JUXTAGLOMERULA SYSTEM OF THE RAT KIDNEY IN THE COURSE OF EXPERIMENTAL HYPOKINESIA c52
I. P. Chernov and A. G. Gaffarov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 84-89 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2 Mar./Apr. 1980 p 54-47 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

A certain correlation between variations in the means of the volume of cortical and juxtamedullary glomerules and the function of the juxtaglomerular apparatus was established. It is hypothesized that at early hypokinesia renal vascular changes are nonspecific. The phenomenon of renal excretion of fluids and electrolytes is explained in terms of a simultaneous increase in the reninangiotensin activity and 11-hydroxycorticosteroid content in plasma.
J.M.S.

N80-28029# Joint Publications Research Service, Arlington, Va.
EFFECT OF HYPOKINESIA ON CHANGES IN CARBOHYDRATE AND LIPID METABOLISM IN THE HEART AND LIVER c52
Yu. P. Rylnikov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 90-96 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2 Mar./Apr. 1980 p 57-62 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

The rate of assimilation of carbohydrates via glycolysis and the pentose-phosphate pathway, as well as changes in B bile in hypokinetic rabbits were studied. Results indicate that rigid immobilization of rabbits is accompanied by a reduction of glycolysis rate in the liver and, particularly, in the heart, and a simultaneous increase of the fraction of carbohydrate utilization in the pentose phosphate pathway. It is also followed by cholesterol accumulation in the blood and tissues in spite of an accelerated bile excretion of cholesterol and its derivatives, biles acids.
J.M.S.

N80-28030# Joint Publications Research Service, Arlington, Va.
EFFECT OF CONDITIONING FOR HYPOXIA ON FERTILITY OF WHITE MICE
V. B. Malkin and Ye. A. Stroganova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 97-102 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 62-66 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

A prolonged effect of hypoxia on the reproductive function and development of pups of white mice was investigated. Beginning with the age of 2 months the animals were exposed to an altitude of 5500 m for 6 hours a day during 9 months. The mice that were so adapted to and mated in hypoxia did not deliver any offspring. The animals that were adapted to hypoxia during intrauterine and postnatal development and mated at 5500 m delivered normal although much smaller litters.
J.M.S.

N80-28031# Joint Publications Research Service, Arlington, Va.
THE QUESTION OF USING DEHYDRATED FOODS DURING LONG-TERM SPACE FLIGHTS c54
V. P. Bychkov and M. V. Markaryan *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 103-109 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 66-70 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

The results of five studies on 35 test subjects conducted to test diets of dehydrated products to be used in prolonged space flights are discussed. It is demonstrated that a diet consisting of only dehydrated food products can be used for a prolonged time (up to 1 year). Dehydrated foods after 2 year storage and proton irradiation at a dose of 24,000 rad retain their biological value and assure and adequate nutritional status. On this basis a space diet composed of dehydrated foods developed.
J.M.S.

N80-28032# Joint Publications Research Service, Arlington, Va.
SYSTEM OF HYGIENIC INSPECTION OF NONMETAL MATERIALS USED IN SPACECRAFT EQUIPMENT c27
G. I. Solomin *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 110-115 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2 Mar./Apr. 1980 p 70-74 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

In view of a wide use of polymers in the spacecraft interior and their 'potential harzard, a system of hygienic control over their safety at every manufacture stage was introduced. The system includes: an analysis of a list of polymers; laboratory testing of samples under standard conditions; bench testing of various polymers used in the hardware and software under operational conditions; and examination of space cabin environments in real flights. The system of hygienic control allows selection of the safest polymers, i.e., those with minimum outgassing.
Author

N80-28033# Joint Publications Research Service, Arlington, Va.
STUDY OF COMPATIBILITY OF CERTAIN HIGHER PLANTS AND CHLORELLA AS RELATED TO A BIOREGENERATIVE HUMAN LIFE SUPPORT SYSTEM c54
Yu. I. Shaydorov, B. N. Shebalin, and G. I. Meleshko *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 116-122 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 74-78 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

Mutual effects of Chlorella and higher plants cultivated together in a closed atmosphere are discussed. It can be inferred that gaseous products of Chlorella did not exert a significant effect on the carbon dioxide consumption by wheat and radish plants or on their biomass increment. In turn, gaseous products of higher plants did not or influence Chlorella growth. It can, therefore, be concluded that Chlorella and the above higher plants, when cultivated in a common atmosphere, do not inhibit each other and can be regarded as biologically compatible constituents of the photoautotrophic component of future bioregenerative life support systems.
J.M.S.

N80-28034# Joint Publications Research Service, Arlington, Va.
GENERALIZED NYSTAGMOMETRIC CHARACTERISTICS FOR DIAGNOSTIC PURPOSES c52
M. M. Leushov and A. I. Tumakov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 123-129 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 78-82 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

The optokinetic reactions of children ranging in age from three to seven years who were not suffering from vestibular dysfunctions were recorded at three stimulus rates. The results of statistical processing for the parameters of right and left optokinetic reactions are reported. A distinct difference in behavior of two parameters of nystagmus, RSC and frequency, is noted.
J.M.S.

N80-28035# Joint Publications Research Service, Arlington, Va.
UPGRADING EFFICACY OF MEMBRANE TECHNIQUES FOR REGENERATING WATER FROM URINE c54
B. A. Adamovich, V. D. Volgin, N. M. Nazarov, Yu. Ye. Sinyak, and S. V. Chizhov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 130-113 ref Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), V. 14, no. 2 Mar./Apr. 1980 p 82-83 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

A method of regenerating water from urine involving evaporation through membranes and reverse osmosis is described. The effectiveness of the process was tested on a laboratory unit with an evaporator made of porous cermet. The productivity of the process was found to be stable over a long period of time. J.M.S.

N80-28036# Joint Publications Research Service, Arlington, Va.
USE OF POLYURETHANE FOAM DEFORMATION SENSOR TO RECORD RESPIRATORY ACTIVITY c35
V. I. Bredov and V. S. Baranov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14 No. 2, 1980 (JPRS-75654) 8 May 1980 p 134-136 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 84-85 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

The sensor developed has some substantial advantages over other known types. It is highly sensitive over a wide range of strain loads. The level of the output signal is linearly related to the force exerted on it, and it is sufficient for direct recording without using amplifiers of electric signals. The sensor is based on elastic, spongy material, polyurethane foam (porolon) with current-conducting material on the pore surface, current-conducting carbon black or electrode paste. The elastic properties of the sensor are built in the actual base of the strain-sensitive element, which simplifies the construction substantially and increases the reliability of the unit. In order to test the possibility of using this sensor to examine respiratory function, human pneumograms were recorded with the subject in a calm state along with the respiratory activity of experimental animals (dogs). Samples of the respiratory curve are shown. The simplicity of design of the sensor makes it possible to use it in various physiological experiments. J.M.S.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-28037 Johns Hopkins Univ., Baltimore, Md.
NONLINEARITIES IN AUDITORY-NERVE FIBER RESPONSES TO BANDLIMITED NOISE: AN EXPERIMENTAL STUDY AND A MODEL Ph.D. Thesis
Thomas Barton Schalk 1980 222 p
Avail: Univ. Microfilms Order No. 8014270

Discharge rate was measured as a function of spectral level for noise bursts of one bandwidth and center frequency. Such rate level functions were measured for a number of bandwidths; either the low or high cutoff frequencies were set at fiber characteristic frequency (CF). Rate level functions were also measured, simultaneously, for single tones at CF. Dynamic range is defined as the range, in dB, over which rate increases from 10 percent to 80 percent of the maximum driven rate to CF tones. When pooling data across CF in single cats, dynamic range is an increasing function of fiber threshold for CF tones and noise stimuli. Narrow bands of noise produce rate-level functions that are similar to those for CF tones. For noise bands centered above CF, rate-level functions became less steep as bandwidth is increased, and are always monotonic. For wide bands of noise centered below CF, rate-level functions can be nonmonotonic or appear to plateau at rates less than the saturation rate to CF tones. Thus, wide bands of noise centered above or below CF can produce lower discharge rates than do narrowbands at the same spectral level. Dissert. Abstr.

N80-28038# Naval Medical Research Inst., Bethesda, Md.
MEASUREMENT OF LUNG FUNCTION USING MAGNETOMETERS. 1: PRINCIPLES AND MATHEMATICAL MODELING Progress Report
Donald L. Vawter Nov. 1979 54 p refs
(AD-A083910; MNRI-79-78; Rept-2) Avail: NTIS HC A04/MF A01 CSCL 06/16

The use of magnetometer systems to predict pulmonary air volumes was studied. The sensitivity of the system to angular rotations was found to be small because magnetometers are normally mounted to the subject. Seven mathematical models for predicing volume were investigated, with the finding that two parameter models are adequate for quiet breathing. For complicated maneuvers, a three-parameter model is necessary, and for predictive usefulness, the model must be calibrated using a complex maneuver. Results of studies of the dimensional changes, and the correlation between the dimensional changes, that occur during normal breathing are presented. Author

N80-28039*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF HYPOKINESIA ON INVERTASE ACTIVITY OF THE MUCOSA OF THE SMALL INTESTINE
A. Abdusattarov Jun. 1980 5 p refs Transl. into ENGLISH from Uzb. Biol. Zh. (USSR), no. 1, 1978 p 61-62 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by Academy of Sciences (USSR)
(NASA-TM-76191) Avail: NTIS HC A02/MF A01 CSCL 06P

The effect of prolonged hypokinesia on the enzyme activity of the middle portion of the small intestine was investigated. Eighty-four mongrel white male rats weighing 170-180 g were divided into two equal groups. The experimental group were maintained in single cages under 30 days of hypokinetic conditions and the control animals were maintained under ordinary laboratory conditions. It is concluded that rates of invertase formation and its inclusion in the composition if the cellular membrane, if judged by the enzyme activity studied in sections of the small intestine, are subject to phase changes in the course of prolonged hypokinesia. R.E.S.

N80-28040*# National Aeronautics and Space Administration, Washington, D. C.
MORPHOFUNCTIONAL CORRELATIONS IN THE EXPERIMENTAL STUDY OF MYOCARDIOPATHIES UNDER THE STRESS OF FORCED RESTRAINT. NOTE 2: THE INFLUENCE OF ADRENAL IMBALANCE
M. Dinu, S. Dolinescu, and A. Sneer May 1980 12 p refs Transl. into ENGLISH from Rev. Med.-Chir. (Iasi) (Romania), no. 1, 1978 p 87-91 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Orginal doc. prepared by Inst. of Med. and Pharmacy
(Contract NASw-3199)
(NASA-TM-76138) Avail: NTIS HC A02/MF A01 CSCL 06S

Tests were performed with 70 rats to determine the effects of restraint on the functions and structure of the myocardium under varying conditions of adrenal imbalance. Results showed that in rats with adrenal imbalance, fasting and restraint produced the same biochemical alterations as in the controls. The morphologic alteractions, as well as their electric expression, were more varied and evident in the animals with adrenal imbalance. Persistence of the microscopic and electrocardiographic alterations after 72 hours restraint in the animals subjected to unilateral adrenalectomy suggests chronic evolution of the myocardial lesions. This proves the necessity of intact adrenals for a good adaptability to stress. L.F.M.

N80-28041*# National Aeronautics and Space Administration, Washington, D. C.
CHANGES OF THE BODY FUNCTIONS DURING LONG-TERM HYPOKINESIA
Ye. A. Kovalenko, V. L. Popkov, Yu. I. Kondratev, E. S. Mailyan, Yu. S. Galushko, A. A. Prokhonchukov, V. A. Kazaryan, R. S. Morozova, L. V. Serova, A. N. Potapov et al May 1980 13 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 6, 1970 p 3-9 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)
(NASA-TM-76166) Avail: NTIS HC A02/MF A01 CSCL 06S

Prolonged hypokinesis (100-170 days) studied in 2000 rats kept in cages limiting their mobility provoked considerable changes in the gaseous and energetic metabolism: an elevation of the total gaseous metabolism and of the rate of O2 requirement by the muscles (in the late periods of hypokinesis) and a change in the intensity of tissue respiration of the liver and myocardium. There also proved to be a reduction in the level of phosphorylation and separation of oxidative phosphorylation in the myocardium, liver, and partially in the skeletal muscle. Prolonged hypokinesis led to changes in tissue metabolism: a disturbance of development of the animals, a marked delay and an increase in the weight of the organism and the muscular system, and disturbances of the mineral and protein metabolism. Prolonged hypokinesis also lead to exhaustion of the hypothalamus-hypophysis-adrenal cortex system. R.E.S.

N80-28042*# National Aeronautics and Space Administration, Washington, D. C.
THE RELATION BETWEEN TILT TABLE AND ACCELERATION-TOLERANCE AND THEIR DEPENDENCE ON STATURE AND PHYSICAL FITNESS
K. E. Klein, F. Backhausen, H. Bruner, J Eichhorn, D. Jovy, J. Schotte, L. Vogt, and H. M. Wegman Apr. 1980 30 p refs Transl. into ENGLISH from Intern. A. Angew. Physiol. (West Germany), v. 26, 1968 p 205-226 Original language document announced as A69-21304 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75796) Avail: NTIS HC A03/MF A01 CSCL 06S

A group of 12 highly trained athletes and a group of 12 untrained students were subjected to passive changes of position on a tilt table and positive accelerations in a centrifuge. During a 20 min tilt, including two additional respiratory maneuvers, the number of fbints and average cardiovascular responses did not differ significantly between the groups. During linear increase of acceleration, the average blackout level was almost identical in both groups. Statistically significant coefficients of product-moment correlation for various relations were obtained. The coefficient of multiple determination computed for the dependence of acceleration tolerance on heart-eye distance and systolic blood pressure at rest allows the explanation of almost 50% of the variation of acceleration tolerance. The maximum oxygen uptake showed the expected significant correlation to the heart rate at rest, but not the acceleration tolerance, or to the cardiovascular responses to tilting. L.F.M.

N80-28043*# National Aeronautics and Space Administration, Washington, D. C.
VERTEBRAL PAIN IN HELICOPTER PILOTS
R. Auffret, R. P. Delahaye, P. J. Metges, and Vicens Jun. 1980 19 p transl. into ENGLISH of "Les Algies Vertebrales des Pilotes d'Helicopteres", Rept. AGARD-CP-255, AGARD, Paris, Dec.1978 7 p Translation was announced as N79-19656 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75792) Avail: NTIS HC A02/MF A01 CSCL 06P

Pathological forms of spinal pain engendered by piloting helicopters were clinically studied. Lumbalgia and pathology of the dorsal and cervical spine are discussed along with their clinical and radiological signs and origins. R.E.S.

N80-28044*# National Aeronautics and Space Administration, Washington, D. C.
THE CONTENT OF CATECHOLAMINES IN THE ADRENAL GLANDS AND SECTIONS OF THE BRAIN UNDER HYPOKINESIA AND INJECTION OF SOME NEUROTROPIC AGENTS
B. E. Melnik and E. S. Paladiy Mar. 1980 10 p refs Transl. into ENGLISH from Biol. Nauki (USSR), v. 15, no. 11, 1972 p 45-49 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by V. I. Lenin Kishinev State Univ. USSR
(Contract NASw-3199)
(NASA-TM-76010) Avail: NTIS HC A02/MF A01 CSCL 06S

The dynamics of catecholamine content were studied in the adrenal glands and in various region of the brain of white rats under hypokinesia and injections of neurotropic agents. Profound changes in body catecholamine balance occured as a result of prolonged acute restriction of motor activity. Adrenalin retention increased and noradrenanalin retention decreased in the adrenal glands, hypothalamus, cerebral hemispheres, cerebellum and medulla oblongata. Observed alterations in catecholamine retention varied depending upon the type of neurotropic substance utilized. Mellipramine increased catecholamine retention in the tissues under observation while spasmolytin brought about an increase in adrenalin concentration in the adrenals and a decrease in the brain. R.E.S.

N80-28045*# National Aeronautics and Space Administration, Washington, D. C.
MECHANISM OF SELECTIVE LESION OF THE CARDIOVASCULAR SYSTEM IN PSYCHO-EMOTIONAL STRESS
Yu. M. Repin and V. G. Startsev Apr. 1979 14 p refs Transl. into ENGLISH from Vestn. Akad. Nauk SSSR (USSR), v. 8, 1975 p 71-76 Translation was announced as N76-12713 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by USSR Acad. of Med. Sci. Inst. for Pathology and Therapy
(Contract NASw-3199)
(NASA-TM-76035) Avail: NTIS HC A02/MF A01 CSCL 06S

A species predisposition to hypertensive and ischemic heart disease occurs in mammals only at the level of primates, and is associated with social regulation of biological reactions. The specific physiological mechanism giving rise to psychonerogenic pathology may be an inhibition of the motor component of the agressive-defensive response. Repeated combination of pursuit with subsequenct immobilization resulted in four out of five experimental baboons developing serious arterial hypertension and ischemic lesion of the heart which lasted many years. Author

N80-28046*# National Aeronautics and Space Administration, Washington, D. C.
RESULTS OF THE INVESTIGATION OF THE OTOLITH FUNCTION IN MANNED SPACE FLIGHTS
L. N. Kornilova, G. D. Synykh, I. K. Tarasov, and I. Ya. Yakovleva Jun. 1980 9 p refs Transl. into ENGLISH from Vestn. Otorino-Laringol. (USSR), no. 6, 1979 p 21-24 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by USSR Ministry of Health, Moscow
(Contract NASw-3198)
(NASA-TM-76103) Avail: NTIS HC A02/MF A01 CSCL 06P

The effects of conditions of long term and short term space flights on the otolith function of cosmonauts were investigated via pre and post examinations. The results show that after long term flight, the intensity of the otolith reflex increased and asymmetry occurred in the indicators of the otolith function. Large changes in terms of expression and duration in the indicators of the otolith function after long term flight as compared with short term flight were also noted. R.E.S.

N80-28047*# National Aeronautics and Space Administration, Washington, D. C.
CHARACTERISTICS OF ENZYMATIC INDUCTION PROVOKED BY CHLORDANE
A. Denys, E. Guilbert-Ber, and Jeanne Levy Jun. 1980 18 p refs Transl. into ENGLISH from Therapie (France), v. 30, 1975 p 277-288 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Inst. of Pharmacology, Paris
(Contract NASw-3198)
(NASA-TM-76194) Avail: NTIS HC A02/MF A01 CSCL 06P

The effects of various stresses, such as restraint and lowering or raising of environmental temperature, in mice pretreated with chlordane were investigated. (Chlordane is an inhibitor of protein synthesis.) It was found that restraint or exposure to a cold environment for three hours mobilized the chlordane stored in the adipose tissue of mice. R.E.S.

N80-28048*# National Aeronautics and Space Administration, Washington, D. C.
CARDIOVASCULAR AND RESPIRATORY PHYSIOPATHOLOGICAL ASPECTS OF HYPOKINESIA
A. Dagianti Jun. 1980 26 p refs Transl. into ENGLISH from Recenti Progr. Med. (Italy), v. 52, no. 4, 1972 p 323-344 Transl. by Scientific Translation Service, Santa Barbara, Calif. (Contract NASw-3198)
(NASA-TM-76198) Avail: NTIS HC A03/MF A01 CSCL 06S

The many effects of hypokinesia on the human organism are described. The differences in normally mobile subjects and hypokinetic subjects as relates to heart rate, average humeral pressure, cardiac capacity, cardia index, systolic range, and large cycle resistances are discussed. It is concluded that further studies must be carried out in seven specific areas of cardiocirculatory damage due to hypokinesia. R.E.S.

N80-28049# Federal Aviation Administration, Washington, D. C. Office of Aviation Medicine.
EFFECTS OF OZONE ON EXERCISING AND SEDENTARY ADULT MEN AND WOMEN REPRESENTATIVE OF THE FLIGHT ATTENDANT POPULATION
E. A. Higgins, M. T. Lategola, J. M. McKenzie, C. E. Melton, and J. A. Vaughan Oct. 1979 106 p refs
(AD-A080045; FAA-AM-79-20) Avail: NTIS HC A06/MF A01 CSCL 06/16

Three studies at two ozone concentrations have been carried out in an attempt to define the effect level for ozone under simulated flight conditions. All experiments were carried out in an altitude chamber held at 6,000 feet MSL: relative humidity was kept at 10-12 percent and temperature at 68 - 74 F. Subjects paid were nonsmoking men and women in their third decade who had the anthropomorphic characteristics of airline flight attendants. All subjects were exposed to ozone in one experiment and to air only in another. Order of presentation of the experiments was balanced, and sessions were separated by 1 week. Study 1 consisted of exposure of 15 men and 12 women to 0.20 parts per million by volume (ppmv) ozone for 4 h with treadmill exercise for the last 10 min of each hour. In the second study 14 men and 14 women were exposed to 0.30 ppmv ozone for 3 h with 10 min exercise at the end of each hour. The third study consisted of exposure of 14 men and 14 women to 0.30 ppmv without exercise. Cardiopulmonary, performance, visual, and symptoms assessments were made. GRA

N80-28050# National Technical Information Service, Springfield, Va.
BIOLOGICAL EFFECTS OF MICROWAVES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Apr. 1980
Elizabeth A. Harrison Apr. 1980 95 p Supersedes NTIS/PS-79/0433; NTIS/PS-78/0432
(PB80-808256; NTIS/PS-79/0433; NTIS/PS-78/0432) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 06R

The selected abstracts cover the biological effects on man and animals from exposure to microwaves. In addition to dosages and tolerances, regulations, and standards are included. This bibliography contains 88 abstracts, 43 of which are new entries to the previous edition. GRA

N80-28051# National Technical Information Service, Springfield, Va.
TOXICITY OF VINYL CHLORIDE. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1969 - Mar. 1980
Elizabeth A. Harrison Apr. 1980 102 p Supersedes NTIS/PS-79/0419; NTIS/PS-78/0442
(PB80-807662; NTIS/PS-79/0419; NTIS/PS-78/0442) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 06T

Research is cited on the health hazards from exposure to vinyl chloride and vinyl chloride resins. Studies are included on the epidemiology of industrial and public exposures to the compound and its degradation and combustion products. This updated bibliography contains 90 abstracts, 8 of which are new entries to the previous edition. GRA

N80-28052# National Technical Information Service, Springfield, Va.
ALTITUDE HYPOXIA. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Mar. 1980
Elizabeth A. Harrison Apr. 1980 47 p
(PB80-807696; NTIS/PS-79/0428; NTIS/PS-78/0443) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 06S

The selected abstracts of research reports cover stress physiology, narcosis, acceleration tolerance, adaptation (physiology), psychophysiology, respiration, metabolism, and cardiovascular system as applied to altitude hypoxia. This updated bibliography contains 40 abstracts, 23 of which are new entries to the previous edition. GRA

N80-27996# Joint Publications Research Service, Arlington, Va.
RESULTS OF STUDIES OF PULSED BLOOD FLOW AND REGIONAL VASCULAR TONUS DURING FLIGHTS IN THE FIRST AND SECOND EXPEDITIONS ABOARD THE SALYUT-6-SOYUZ ORBITAL COMPLEX
V. F. Turchaninova and M. V. Domracheva *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 13-18 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 11-14 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-27997# Joint Publications Research Service, Arlington, Va.
CIRCULATION IN EXERCISING CREW MEMBERS OF THE FIRST MAIN EXPEDITION ABOARD SALYUT-6
V. S. Georgiyevskiy, N. A. Lapshina, L. Ya. Andriyako, L. C. Umnova, V. G. Doroshev, I. V. Alferova, V. N. Ragozin, and Ye. A. Kobzev *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 19-23 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 15-18 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-27998# Joint Publications Research Service, Arlington, Va.
HEMODYNAMICS AND PHASE STRUCTURE OF THE CARDIAC CYCLE IN MEMBERS OF THE FIRST CREW OF SALYUT-6 AT REST
V. A. Degtyarev, V. G. Doroshev, N. A. Lapshina, V. N. Ragozin, Z. A. Kirillova, S. I. Ponamarev, and O. B. Kulikov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 24-28 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 18-21 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28004# Joint Publications Research Service, Arlington, Va.
HUMAN COLOR DISCRIMINATING FUNCTION WITH MUSCULAR TENSION DURING EXPOSURE TO VESTIBULAR STIMULI
Zh. M. Kudryashova and A. A. Shipov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 60-64 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 41-44 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28008# Joint Publications Research Service, Arlington, Va.
STUDIES OF PROGNOSTIC SIGNIFICANCE OF ANTIORTHOSTATIC POSITION
Kh. Kh. Yarullin, V. A. Gornago, T. D. Vasilyeva, and M. Ye. Gugushvili *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 72-80 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 48-54 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28007# Joint Publications Research Service, Arlington, Va.
EVALUATION OF EFFICACY OF THE SET OF PREVENTIVE MEASURES REFERABLE TO THE HUMAN NEUROMUSCULAR SYSTEM UNDER HYPOKINETIC CONDITIONS
V. A. Tishler, V. I. Safonov, and Z. A. Krivitsina *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 81-85 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), no. 3, 1980 p 54-57 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28008# Joint Publications Research Service, Arlington, Va.
THE STRESS REACTION TO HYPOKINESIA AND ITS EFFECT ON GENERAL RESISTANCE
I. P. Chernov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 86-90 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 57-60 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28010# Joint Publications Research Service, Arlington, Va.
SECRETION, INCRETION AND RESECRETION OF PANCREATIC LIPASE DURING PROLONGED RESTRICTION OF MOTOR ACTIVITY
I. L. Medkova, N. M. Nikolayeva, and K. V. Smirnov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 97-103 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 64-67 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28011# Joint Publications Research Service, Arlington, Va.
THEORETICAL ANALYSIS OF THE EFFECT OF STATE OF PULMONARY CIRCULATION ON DISTRIBUTION OF VENTILATION-PERFUSION RELATIONS AND GAS EXCHANGE IN THE LUNGS
A. I. Dyachenko and V. G. Shabelnikov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 104-109 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 68-71 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28012# Joint Publications Research Service, Arlington, Va.
METHOD FOR ASSESSING HEMODYNAMICS AND DETECTING LATENT INSUFFICIENCY OF CEREBRAL CIRCULATION IN COSMONAUT CANDIDATES
D. A. Alekseyev *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 110-116 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 71-74 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28013# Joint Publications Research Service, Arlington, Va.
ULTRASONIC METHOD OF RECORDING GAS BUBBLES IN ANIMAL VENOUS BLOOD IN A RAREFIED ATMOSPHERE
R. T. Kazakova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 117-121 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 74-76 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28016# Joint Publications Research Service, Arlington, Va.
RESPIRATION AND GAS EXCHANGE UNDER HYPERBARIC CONDITIONS
L. A. Bryantseva, I. S. Breslav, and A. G. Dianov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 1-14 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 3-10 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

N80-28017# Joint Publications Research Service, Arlington, Va.
CIRCULATION AT REST IN CREW MEMBERS OF THE FIRST MAIN EXPEDITION ABOARD SALYUT 6
V. A. Degtyarev, V. G. Doroshev, V. M. Mikhaylov, V. S. Georgiyevskiy, S. A. Kobzev, Z. A. Kirillova, N. A. Lapshina, V. G. Savelyeva, and L. V. Umnova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 15-19 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 11-14 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

N80-28018# Joint Publications Research Service, Arlington, Va.
STATE OF HUMAN BONE TISSUE PROTEIN FRACTION AFTER SPACE FLIGHTS
A. A. Prokhonchukov, V. K. Leontyev, N. A. Zhizhina, R. A. Tigranyan, A. G. Kolesnik, and N. A. Komissarova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 20-26 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 14-18 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

N80-28024# Joint Publications Research Service, Arlington, Va.
DYNAMICS OF HUMAN EXTERNAL RESPIRATION AND BLOOD GASES UNDER THE COMBINED EFFECT OF HYPERCAPNIA AND HYPOXIA
L. Kh. Bragin, A. Ye. Severin, N. A. Agadzhanyan, G. A. Davydov, and Yu. A. Spasskiy *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 58-62 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 38-41 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

N80-28025# Joint Publications Research Service, Arlington, Va.
FUNCTIONAL STATE OF THE CARDIOVASCULAR SYSTEM UNDER THE COMBINED EFFECT OF 28 DAY IMMERSION, ROTATION ON A SHORT-ARM CENTRIFUGE AND EXERCISE ON A BICYCLE ERGOMETER
I. F. Vil-Vilyams and Ye. B. Shulzhenko *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 63-68 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 42-45 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

N80-28026# Joint Publications Research Service, Arlington, Va.
PHARMACOLOGICAL ANALYSIS OF PHYSIOLOGICAL MECHANISMS OF ORTHOSTATIC HEMODYNAMIC STABILITY
L. I. Osadchiy *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 69-74 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 45-49 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

N80-28027# Joint Publications Research Service, Arlington, Va.
BIOELECTRIC ACTIVITY OF THE HUMAN BRAIN DURING AND AFTER 182-DAY ANITORTHOSATIC HYPOKINESIA
T. N. Krupina, Kh. Kh. Yarullin, and D. A. Alekseyev *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 75-83 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14,

no. 2, Mar./Apr. 1980 p 49-54 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

N80-28029# Joint Publications Research Service, Arlington, Va.
MORPHOMETRIC ANALYSIS OF GLOMERULES AND JUXTAGLOMERULA SYSTEM OF THE RAT KIDNEY IN THE COURSE OF EXPERIMENTAL HYPOKINESIA
I. P. Chernov and A. G. Gaffarov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 84-89 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2 Mar./Apr. 1980 p 54-47 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

N80-28029# Joint Publications Research Service, Arlington, Va.
EFFECT OF HYPOKINESIA ON CHANGES IN CARBOHYDRATE AND LIPID METABOLISM IN THE HEART AND LIVER
Yu. P. Rylnikov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 90-96 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2 Mar./Apr. 1980 p 57-62 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

N80-28034# Joint Publications Research Service, Arlington, Va.
GENERALIZED NYSTAGMOMETRIC CHARACTERISTICS FOR DIAGNOSTIC PURPOSES
M. M. Leuashov and A. I. Tumakov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 123-129 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 78-82 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-28053 New York Univ., N. Y.
RESPONSE TIME, OPERATOR PRODUCTIVITY AND JOB SATISFACTION Ph.D. Thesis
Raymond Earle Barber 1979 117 p
Avail: Univ. Microfilms Order No. 8014200

The impact is examined of on-line system response time on operator productivity and job satisfaction. A user organization in Cincinnati, Ohio and its five on-line systems provided the environment for the study. The impact of response time on productivity suggests that all or nearly all (e.g., 98%) transactions should be completed in 12 seconds or less. Beyond this level, the user organization suffers severe penalties in lost productivity. When response times are less than six seconds, productivity is relatively flat. That is, the impact of response time on productivity is not as great when average response time is less than six seconds as it is when average response time is greater than six seconds. It is concluded that the normal operating range of the systems studied should be in the four to six second range. It was predicted, prior to the study, that all categories of job satisfaction would be adversely affected by longer response times. The results, however, indicate that response time has a mixed impact on job satisfaction. Some categories showed decreased satisfaction as predicted. Others, however, demonstrated an improvement in job satisfaction as response time increased. These were mainly categories dealing with interpersonal relationships. Based upon the results the implications of response time on system operation and system design are discussed. A method is suggested that would allow the response time models to be applied to other online systems. Desirable directions for future research are discussed in depth. Dissert. Abstr.

N80-28002# Joint Publications Research Service, Arlington, Va.
SOME ASPECTS OF APPLICATION OF THE SYSTEMIC APPROACH TO AVIATION ENGINEERING PSYCHOLOGY
V. A. Ponomarenko and N. D. Zavalova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 47-52 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 33-37 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28003# Joint Publications Research Service, Arlington, Va.
EFFECT OF PROLONGED +Gz ACCELERATIONS ON HUMAN PERFORMANCE
A. S. Barer, T. A. Sokolova, V. M. Tardov, and Yu. P. Yashin *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 53-59 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 37-40 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28023# Joint Publications Research Service, Arlington, Va.
EFFECT OF HIGH AMBIENT TEMPERATURE ON HUMAN PERFORMANCE
A. N. Azhayev, V. I. Zorile, and A. N. Koltsov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 53-57 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 20 Mar./Apr. 1980 p 35-38 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-28054# Perceptronics, Inc., Woodland Hills, Calif.
A CONCEPT FOR DEVELOPING HUMAN PERFORMANCE SPECIFICATIONS Final Report
Jonathan D. Kaplan and William H. Crooks Aberdeen Proving Ground, Md. Human Eng. Labs. Apr. 1980 47 p refs
(Contract DAAK11-79-C-0115)
(AD-A084617; PTR-2020-80-3; HEL-TM-7-80) Avail: NTIS HC A03/MF A01 CSCL 15/5

OMB Circular A-109 emphasizes the front end of systems acquisition with the intent of (1) expressing needs and program objectives in 'mission' terms rather than 'equipment' terms, and (2) allowing competitive exploration of alternative methods of meeting those needs. For human factors specialists to comply with these requirements, it will be necessary for them to produce explicit specifications for the critical human performance which is required for system performance. This paper presents a concept for producing these required human performance specifications prior to the initial design of a system. It also presents an example of a detailed human performance specification as well as Appendices containing material used to produce human performance specifications for various kinds of systems. GRA

N80-28055# National Bureau of Standards, Washington, D.C. Product Safety Technology Div.
A MATHEMATICAL MODEL FOR USE IN EVALUATING AND DEVELOPING IMPACT TEST METHODS FOR PROTECTIVE HEADGEAR
Robert E. Berger Oct. 1979 79 p
(PB80-164957; NBSIR-80-1987) Avail: NTIS HC A05/MF A01 CSCL 06Q

A lumped parameter mathematical model was developed to connect injury parameters in real life head impact environments to output parameters of test methods for evaluating protective headgear. Analytical/experimental schemes were developed for

mathematically representing the parameters that characterize each of the three distinct elements of the model: the head or headform; the impact surface; and the helmet. The model was shown to be useful in determining test method pass/fail criteria which corresponds to the threshold of injury in the real life situation.
GRA

N80-27996# Joint Publications Research Service, Arlington, Va.
BIOCHEMICAL BASES OF PATHOGENESIS OF HYPOKINESIA
I. V. Fedorov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 1-12 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 3-10 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28031# Joint Publications Research Service, Arlington, Va.
THE QUESTION OF USING DEHYDRATED FOODS DURING LONG-TERM SPACE FLIGHTS
V. P. Bychkov and M. V. Markaryan *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 103-109 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 66-70 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

N80-28033# Joint Publications Research Service, Arlington, Va.
STUDY OF COMPATIBILITY OF CERTAIN HIGHER PLANTS AND CHLORELLA AS RELATED TO A BIOREGENERATIVE HUMAN LIFE SUPPORT SYSTEM
Yu. I. Shaydorov, B. N. Shebalin, and G. I. Meleshko *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 116-122 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 74-78 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

N80-28035# Joint Publications Research Service, Arlington, Va.
UPGRADING EFFICACY OF MEMBRANE TECHNIQUES FOR REGENERATING WATER FROM URINE
B. A. Adamovich, V. D. Volgin, N. M. Nazarov, Yu. Ya. Sinyak, and S. V. Chizhov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 130-113 ref Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), V. 14, no. 2 Mar./Apr. 1980 p 82-83 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N80-28056*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPROACH TO SOUNDING ON THE VAS PROCESSOR
Dennis Chesters Mar. 1980 23 p refs
(NASA-TM-80713) Avail: NTIS HC A02/MF A01 CSCL 09B

The key features of the sounding software laboratory being installed on the VAS Processor at NASA/GSFC are outlined. Emphasis is on the support data and personal guidance that a meteorological researcher must provide to attune a physically modeled VAS sounding to his experiment. The fundamental aim of the sounding-support effort is to provide a system which makes use of: radiation transfer models based upon laboratory data, analytic inversion schemes, human guidnace for quality control, statistically conditioned retrieval methods, and current ancillary data.
Author

N80-28067# Computer Corp. of America, Cambridge, Mass.
SPATIAL DATA MANAGEMENT SYSTEM Quarterly Research and Development Technical Report, 1 Sep. - 30 Nov. 1979
David Kramlich, Christopher F. Herot, Richard Carling, and Mark Friedell 30 Nov. 1979 38 p refs
(Contract MDA903-78-C-0122; APRA Order 3487)
(AD-A083729) Avail: NTIS HC A03/MF A01 CSCL 09/2

Work on the design and implementation of a prototype Spatial Data Management System (SDMS) is described. Spatial Data Management is a technique for storing and retrieving information which employs pictorial representations of data arranged on a collection of flat surfaces which the user can view on a color, raster scan display. Tools are provided for interactively entering graphical and symbolic data, including a mechanism for generating graphical representations of existing, shared symbolic data bases. Several new features that increase the utility of the system were implemented. These are: a new statement in the modified query language of the underlying DBMS; extensions to the graphical editor; extensions to the module which manages objects in the graphical Data Space (GDS); and a terminal emulator to provide a text interface to SDMS.
GRA

N80-28058# Naval Postgraduate School, Monterey, Calif.
PERFORMANCE PREDICTION FROM A COMPUTER HARDWARE DESCRIPTION
Lyle Ashton Cox, Jr. Dec. 1979 25 p refs
(RR0000110)
(AD-A083842; NPS52-79-001) Avail: NTIS HC A02/MF A01 CSCL 09/2

Today's computers are among the most complex man made systems in existence today. How can we make our designs not only more precise, but make these systems more accurately and cost effectively achieve their goals? We have begun to rely upon computer aided design techniques. The use of these techniques often commences not with the statement of the system goals, but rather with the specification of an architecture and a logic technology. In view of the high costs of computer development, we should be quite confident that our architecture/technology combination is capable of meeting the system requirements before we proceed to more detailed design phases. The entire system design process must be integrated, and include performance prediction and verification techniques. This design process should be reflected in a single description language. A methodology for accomplishing this goal capable of employing many existing design practices is discussed here.
GRA

N80-28059# SRI International Corp., Menlo Park, Calif. Computer Science Lab.
FORMAL TECHNIQUES FOR FAULT-TOLERANCE IN DISTRIBUTED DATA PROCESSING (DDP) Final Report
Jack Goldberg, William H. Kautz, Leslie Lamport, Peter G. Neumann, Robert E. Shostak, and Marshal C. Pease 1 May

1980 70 p refs
(Contract DASG60-78-C-0046; SRI Proj. 7242)
(AD-A084537) Avail: NTIS HC A04/MF A01 CSCL 09/2

Previous work on the logical specification of distributed systems has been continued. The basic approach involves specifying the logical functioning of the system in terms of an abstract state machine. Part of the fault-tolerance of the system is achieved by the reliability of this state machine. However, the problem of faulty inputs must be explicitly handled by the state machine. A fault-tolerant DDP system must handle malfunctioning components that give conflicting information to different parts of the system. This problem is expressed abstractly as the 'Byzantine Generals Problem', involving a group of generals communicating by messenger who must reach agreement upon a common battle plan despite the fact that one or more of them may be traitors trying to confuse the others. Several solutions are described and their use in implementing fault-tolerant DDP systems is discussed. Achieving fault-tolerance requires the detection and diagnosis of faults. Our work on the diagnosis of faulty nodes and communication links in a DDP system is described. In the event of a failure, one would like a DDP system to recover rapidly with a minimal loss of information. The value of a hierarchical design methodology in achieving a recovery capability is discussed. GRA

N80-28060# Verchron Systems, Saline, Mich.
DISTRIBUTED SENSOR SYSTEMS AND ELECTROMECHANICAL ANALOG FACILITY Final Report
Richard A. Volz, S. L. Bement, Richard Jungclas, T. Rosenbaum, E. J. Sesek, J. Wenstrand, S. Cagliastro, A. Zemon, and P. Beck (ARADCOM, Dover, N.J.) Jan. 1980 500 p refs
(Contract DAAG29-76-D-0100)
(AD-A084656; AD-E400397; ARPAD-CR-80001) Avail: NTIS HC A21/MF A01 CSCL 09/2

Distributed sensor systems are key ingredients in many real world applications. Specific instances abound both in industrial and military environments, e.g., the monitoring (and possibly control) of manufacturing operations, or the dispersion of various types of sensors to detect enemy movements. There are two major areas of study in distributed sensors: the design and development of the sensors themselves, and the logical use of such sensors. This report is directed toward mechanisms to study the latter. Some examples of the latter, explained in detail, are based on CICE/ECE/IOE 469, a course in Real Time Computing Systems developed at the University of Michigan, Ann Arbor. Both student and faculty critiques of the electromechanical analog facility used in the program are included. GRA

N80-28061# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
COMPUTER SCIENCE AND TECHNOLOGY: VALIDATION VERIFICATION, AND TESTING FOR THE INDIVIDUAL PROGRAMMER Final Report
Martha A. Branstad, John C. Cherniavsky, and W. Richards Adrion Feb. 1980 31 p refs
(PB80-166960; NBS-SP-500-56; LC-80-600005) Avail: NTIS HC A03/MF A01 CSCL 09B

Guidelines are given for program testing and verification to insure quality software for the programmer working alone in a computing environment with limited resources. The emphasis is on verification as an integral part of the software development. Guidance includes developing and planning testing as well as the application of other verification techniques at each lifecycle stage. Relying upon neither automated tools nor formal quality assurance support, the guidelines should be appropriate for applications programmers doing small development projects. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-28062 Purdue Univ., Lafayette, Ind.
OPTIMIZATIONS OF STOCHASTIC SYSTEMS THROUGH SIMULATION USING STOCHASTIC APPROXIMATION METHOD Ph.D. Thesis
Farhad Azadivar 1979 170 p
Avail: Univ. Microfilms Order No. 8015423

An algorithm was developed for optimizing the response function of simulation models with stochastic behavior. Principles of stochastic approximation were used in developing this algorithm which guaranteed convergence to the optimum, if large number of observations were made. The algorithm yielded accurate answers even when the number of observations were not too large. The algorithm is further developed to optimize such simulation models even when the decision variables were subject to a set of linear constraints. Dissert. Abstr.

N80-28063 Kansas State Univ., Manhattan.
A STUDY OF THE SEQUENTIAL REGRESSION (SER) ALGORITHM AND ITS APPLICATIONS
David Lynn Soldan 1979 160 p
Avail: Univ. Microfilms Order No. 8015280

The sequential regression (SER) algorithm which enables a direct adaptive implementation of the least squares optimum filter is discussed. It has superior convergence characteristics when compared to other algorithms. Since the SER algorithm computes the inverse of the autocorrelation matrix of the input data, problems can arise if a unique inverse does not exist. A modification is given that guarantees a unique solution thus enabling the SER algorithm to be used for all input signals. Factors that effect the performance of an adaptive filter implementing the SER algorithm when it is in a long-term signal processing environment are also considered. An additional modification is presented to obtain the performance necessary for long-term signal processing. The results revolving the SER algorithm for phase compensation are given. These clearly demonstrate that the performance of the SER algorithm is superior to existing algorithms used for this purpose. Dissert. Abstr.

N80-28064 Ohio State Univ., Columbus.
TREATMENT OF UNGRAMMATICAL AND EXTRAGRAMMATICAL PHENOMENA IN NATURAL LANGUAGE UNDERSTANDING SYSTEMS Ph.D. Thesis
Stan C. Kwasny 1980 148 p
Avail: Univ. Microfilms Order No. 8015897

Several language phenomena commonly considered deviant by linguistic standards, and how they might be integrated into a computer model for understanding Natural Language were investigated. Techniques developed within the Augmented Transition Network (ATN) model are shown to be adequate to relate many of these cases to well-formed counterparts. First, linguistic problems are defined and discussed and then techniques for overcoming these problems are presented. The techniques require a normative grammar be given which specifies the processing required of grammatical inputs. Our mechanisms work to relate ungrammatical inputs to appropriate grammatical ones and to process them accordingly. The mechanisms proposed include two techniques for relaxing restrictions in the grammar, a new arc type employing pattern matching, and a method for dynamically ordering the evaluation of arcs. The efficiency and structural characteristics of the original normative grammar are not altered by these mechanisms. Dissert. Abstr.

N80-28065 California Inst. of Tech., Pasadena.
A SOFTWARE DESIGN SYSTEM Ph.D. Thesis
Gideon David Hess 1980 193 p
Avail: Univ. Microfilms Order No. 8016367

The goal of the research was to build a system that supports, without interfering with, the activity of systematic software design and takes upon itself mechanical activities the designer can be spared. Two of the main activities which constitute the process of software creation are: (1) designing a solution to the problem; (2) implementing the design. The activity of design has to be performed by the programmer himself, it can only be aided by the computer. Producing a program from a complete design is a mechanical activity the computer can take upon itself. These observations lead to the following objectives that a software design system should meet: (1) Providing tools that support the design activity and enable maximum flexibility; (2) Recognizing the lowest level primitives of the design as the target language and producing the program in this language. A system along

these guidelines was implemented. It permits the user to write definitions which refine high level design decisions into lower levels and, at the same time, serve as syntax descriptions and translation rules for the languages used in the design.
Dissert. Abstr.

N80-28066 Rochester Univ., N. Y.
PROGRAM CHECKING Ph.D. Thesis
Graeme John Williams 1980 130 p
Avail: Univ. Microfilms Order No. 8014345

A set of language features for declaring properties of variables. The scheme allows for richer descriptions of variables than simple data types is more expressive than the type mechanism in other languages, and can be checked efficiently. Properties differ from types in that a variable may have more than one property, and the matching of the actual argument of a procedure call to the formal in the definition is by implication. There are two kinds of properties: interpreted and uninterpreted. Interpreted properties depend only on the value of a variable, for example positive or odd. They can be defined with a built-in unary relation and a variable, such as odd(x), or with a binary relation, a variable and a constant, such as $y > 0$. They are a natural extension of subrange types. Uninterpreted properties provide implicit information about the domain of a variable. For example one variable might be a number of apples, another a number of organges. Uninterpreted properties allow each variable to be labelled with the property apples or oranges. A property fruit related to both apples and oranges, may be defined, so that adding apples to oranges makes sense if finding the total number of fruit, but not otherwise. Dissert. Abstr.

N80-28067 Cornell Univ., Ithaca, N. Y.
THE APPLICATION OF REGRESSION METHODS TO THE INITIAL TRANSIENT PROBLEM IN COMPUTER SIMULATIONS Ph.D. Thesis
Mark Kamerer Snell 1980 178 p
Avail: Univ. Microfilms Order No. 8015742

Regression methods were developed for inferring first order stationary behavior of simulated systems. The multivariate response sampled during a simulation experiment was regarded as a stationary stochastic process contaminated by an additive stochastic transient process. The transient process was introduced when initial conditions for the runs in the experiment were selected. Parameters of an underlying stationary model were estimated when the transient contamination was present. Both point and interval estimators were considered. The procedure, under stipulated conditions, lead to estimators that were consistent, efficient and converge in law to a multivariate normal distribution. Two general growth models were proposed for the transient process. These regressors were used to improve short run length bias due to initialization. The consequences of misspecification of the transient model were studied.
Dissert. Abstr.

N80-28068 Purdue Univ., Lafayette, Ind.
A COMPUTER GRAPHICS SYSTEM FOR MACROMOLECULAR MODEL BUILDING Ph.D. Thesis
James Ross Miller 1979 243 p
Avail: Univ. Microfilms Order No. 8015492

A design system was developed which automatically segments and pages the electron density map data and allows users to build molecular models into this map a single residue at a time. All communications between the user and the system was in the language of the model builder. The system was tested by constructing a model of southern bean mosaic virus (SBMV) into a 2.8 angstrom resolution electron density map. With a few exceptions the resultant molecular coordinates were found to be in close agreement with those obtained from building a physical model of SBMV into the same map, and the time required to build the model on the graphics system was much less than that required for the physical model. Dissert. Abstr.

N80-28069# Wisconsin Univ. - Madison. Mathematics Research Center.
PROGRAMMING LANGUAGE FACILITIES FOR NUMERICAL COMPUTATION Progress Report
John R. Rice Jan. 1980 33 p refs
(Contract DAAG29-75-C-0024)
(AD-A083815; MRC-TSR-2033) Avail: NTIS HC A03/MF A01 CSCL 09/2

Numerical software to stimulate discussion of a possible group project is presented. The project is to describe the facilities in a programming language that make it useful for numerical computation. The facilities are classified and their importance measured. A framework for this project and an initial draft of the facility descriptions is presented. The opinions and ratings contained here are those of the author and do not reflect a consensus of IFIP WG 2.5. GRA

N80-28070# Naval Research Lab., Washington, D. C. Applied Optics Branch.
HYBRID IMAGE PROCESSING SYSTEM Final Report
T. H. May and J. A. Blodgett 18 Mar. 1980 14 p refs
(RR0110741)
(AD-A084563; AD-E000415; NRL-8389) Avail: NTIS HC A02/MF A01 CSCL 09/2

A hybrid optical/digital image processing system has been developed for an ongoing research program in hybrid image processing. This system is described and its capabilities and limitations are discussed. Major system components include a coherent optical processor, digital processor (mini-computer), and optical/digital input/output (I/O) devices. The I/O devices include an image dissector camera, microdensitometer, video camera, and film writer. An extensive menu-oriented software package is installed in this system. GRA

N80-28071# Maryland Univ., College Park. Computer Science Center.
PROBABILITY TRANSFORMS OF DIGITAL PICTURES
Ann Scher and Azriel Rosenfeld Apr. 1979 24 p refs
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A084286; TR-758) Avail: NTIS HC A02/MF A01 CSCL 09/2

Let g be any local property (e.g., gray level or gradient magnitude) defined on a digital picture. Let pg(z) be the relative frequency with which g has value z. At each point (x,y) of the picture we can display pg(g(x,y)), appropriately scaled; the result is called the pg-transform of the picture. Alternatively, we can use joint or conditional frequencies of pairs of local properties to define transforms. This note gives examples of such transforms for various g's and h's and discusses their possible uses and limitations. GRA

N80-28072# Maryland Univ., College Park. Computer Vision Lab.
A PATH-LENGTH DISTANCE TRANSFORM FOR QUADTREES
Michael Shneier Jul. 1979 41 p refs
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A084293; TR-794) Avail: NTIS HC A03/MF A01 CSCL 05/8

The size of a region in an image and distances between subregions of an image are useful geometric properties for describing region shape. In particular, the distance of interior points from the border is a useful measure for operations such as thinning and finding skeletons of regions. Most algorithms for finding the distance from a point inside a region to the border have involved multiple passes over the data, each pass incrementing a local counter denoting the distance of the associated point in the image. This paper presents an algorithm that computes the distance function in a single pass over an image represented by a quadtree. A distance measure is defined for a quadtree representation of a binary image. An algorithm is presented that calculates the distance from the center of each BLACK node to the border of the nearest WHITE node. The distance is defined as the path length from the center of the BLACK node, through the center of intervening BLACK nodes, to the WHITE border. The worst case average execution time is shown to be proportional to the product of the log of the image diameter and the number of blocks in the image. GRA

N80-28073# Lockheed Missiles and Space Co., Palo Alto, Calif. Applied Mechanics Lab.
INTERACTIVE NONLINEAR STRUCTURAL ANALYSIS. A REVIEW OF THE GIFTS-STAGS UNION Final Report
31 Mar. 1980 24 p refs

(Contract N00014-79-C-0070)
(AD-A084209; LMSC-D686137) Avail: NTIS HC A02/MF A01 CSCL 09/2

The three primary tasks were: (1) the GIFTS and STAGS finite element programs were to be data-base linked permitting GIFTS graphics-interactive pre- and post-processing of STAGS batch nonlinear structural analysis; (2) interactive software was to be introduced to facilitate convenient operation of the software assembly; and (3) the resulting integrated system was to be verified and documented. The corresponding results: (1) it is now possible to utilize GIFTS pre-and post-processing for a limited variety of STAGS analyses; (2) the software assembly is accessible to the user within a totally conversational environment in which both batch and interactive phases of analysis are prepared, managed and data-base monitored; and (3) current capabilities have been verified with respect to a modest selection of sample problems. GRA

N80-28074# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
BMG REFERENCE MANUAL Technical Report, 20 Mar. 1979 - 19 Mar. 1980
Norton Greenfield, Frank Zdybel, Eugene Ciccarelli, and Martin Yonke Apr. 1980 58 p refs
(Contract N00039-79-C-0316; ARPA Order 3740)
(AD-A084454; BBN-4388) Avail: NTIS HC A04/MF A01 CSCL 09/2

This is the second design and implementation round of the BMG (for Bit Mapped Graphics) package in use at Bolt Beranek and Newman Inc's. Information Sciences Division for experimentation with the concepts and limitations of raster scan graphics systems. It is being used by research projects in command and control systems, natural language systems, and other advanced user interface work. This reference manual for the BMG system is intended primarily for Interlisp programmers who wish to interface an application directly to the graphics system. GRA

N80-28075# Aerospace Corp., El Segundo, Calif. Engineering Group.
THE ELECTRIC SIMULATOR PROGRAM (ESP) USAGE GUIDE Interim Report, 1 Jul. 1975 - 1 Dec. 1979
Emmagene R. Coffey and Harvey J. Wertz 1 May 1980 203 p refs
(Contract F04701-79-C-0080)
(AD-A084676; TR-0080(9320)-1; SD-TR-80-21) Avail: NTIS HC A10/MF A01 CSCL 09/2

The Eclectic Simulator Program (ESP) is a system (a precompiler plus a collection of subroutines) that permits the fast, easy solution of ordinary differential equations. Any user with a general knowledge of FORTRAN can utilize ESP's many labor saving devices to code a problem with minimal effort. Special ESP features permit translation of engineering blocks, discontinuities, and hysteresis patterns directly into computer code, and the use of WHELP in conjunction with ESP facilitates efficient coding of matrix algebra equations. Simple input cards enable the user to directly control solution and timing accuracy and to specify or change run times, initial conditions, and various other parameters easily when making multiple or stacked runs. Finally, ESP allows the user to select from a wide variety of output options. This manual is intended to be both a learning tool for the novice and a detailed reference for the experienced user. GRA

N80-28076# Texas Univ. at Austin. Center for Cybernetic Studies.
COMPLEXITY AND COMPUTABILITY OF SOLUTIONS TO LINEAR PROGRAMMING SYSTEMS
A. Charnes, W. W. Cooper (Harvard Univ., Cambridge, Mass.), S. Duffuaa, and M. Kress Feb. 1980 39 p refs
(Contracts N00014-75-C-0569; N00014-80-C-0242; NR Proj. 047-071; NR Proj. 047-021)
(AD-A084682; CCS-367) Avail: NTIS HC A03/MF A01 CSCL 09/2

Complexity, computability and solution of linear programming systems are re-examined in the light of Khachian's new notion of (approximate) solution. Algorithms, basic theorems and alternate representations are reviewed. It is shown that the Klee-Minty example has never been exponential for (exact) adjacent extreme point algorithms and that the Balinski-Gomory (exact) algorithm is polynomial where (approximate) ellipsoidal 'center-cut-off' algorithms (Levin, Shor, Khachian, Gacs-Lovasz) are exponential. Both the Klee-Minty and the new J. Clausen example are shown to be trivial (explicitly solvable) interval programming problems. A new notion of computable (approximate) solution is proposed together with an a priori regularization for linear programming systems. New polyhedral 'constraint contraction' algorithms are proposed for approximate solution and the relevance of interval programming for good starts or exact solution is brought forth. GRA

N80-28077# Texas A&M Univ., College Station. Inst. of Statistics.
ONESAM, A COMPUTER PROGRAM FOR NONPARAMETRIC DATA ANALYSIS AND DENSITY QUANTILE ESTIMATION
Emanuel Parzen and Scott Anderson Mar. 1980 78 p
(Contract DAAG29-80-C-0070)
(AD-A084259; TR-B-1; ARO-16992.1-M) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report is a User's Guide to ONESAM, a mainline FORTRAN computer program that implements the one sample nonparametric data analysis and Goodness of Fit procedures introduced by Parzen. GRA

N80-28078# Northwestern Univ., Evanston, Ill. Dept. of Electrical Engineering.
PERFORMANCE RIPPLE EFFECT ANALYSIS FOR LARGE-SCALE SOFTWARE MAINTENANCE Interim Report, Nov. 1977 - Nov. 1979
Stephen S. Yau and James S. Collofiello Griffiss AFB, N.Y. RADC Mar. 1980 125 p refs
(Contract F30602-76-C-0397; AF Proj. 5581)
(AD-A084351; RADC-TR-80-55) Avail: NTIS HC A06/MF A01 CSCL 09/2

This report analyzes the possible ripple effect of software modifications during the maintenance phase on the performance of the system, and leads to the development of a maintenance technique for predicting which performance requirements in the system may be affected by a proposed modification. This report formalizes the technique outlined in our previous report entitled, Performance Considerations in the Maintenance Phase of Large-Scale Software Systems. This technique enables maintenance personnel to incorporate performance considerations in their criteria for selecting the types and locations of software modifications to be made. After the maintenance changes have been implemented, this technique can also be useful to the retesting effort of the system by identifying which performance requirements must be reverified to insure that they have not been violated by the maintenance activity. This technique is applicable to all types of large-scale software systems possessing performance requirements, including multiprocessing systems. In the development of this technique, mechanisms for the propagation of performance changes from one part of the system to another are identified. Performance attributes and critical software sections are also identified. GRA

N80-28079# National Technical Information Service, Springfield, Va.
INTERACTIVE COMPUTER GRAPHICS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Mar. 1980
Brian Carrigan Apr. 1980 208 p Supersedes NTIS/PS-79/0278 and NTIS/PS-78/0223
(PB80-807738; NTIS/PS-79/0278; NTIS/PS-78/0223)
Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

A bibliography containing 201 abstracts addressing hardware and software equipment for interactive graphics systems is prestented. The bibliography includes applications in a variety of fields. GRA

N80-28080# National Technical Information Service, Springfield, Va.
INTERACTIVE COMPUTER GRAPHICS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Feb. 1980
Brian Carrigan Apr. 1980 274 p Supersedes NTIS/PS-79/0280; NTIS/PS-78/0224

(PB80-807746; NTIS/PS-79/0280; NTIS/PS-78/0224) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

A bibliography citing 267 abstracts from worldwide literature on computer hardware and computer software implementation of interactive graphics systems is given. Included are applications in a variety of fields. GRA

N80-28081# Michigan State Univ., East Lansing. Dept. of Commerce.
EVALUATION OF PROJECTION ALGORITHMS
Gustum Biswas, Anil K. Jain, and Richard Dubes Sep. 1979 55 p refs
(Grant NSF ENG-76-11936)
(PB80-163702) Avail: NTIS HC A04/MF A01 CSCL 09B

Several linear and nonlinear mapping algorithms for the projection of patterns from a high dimensional space to two dimensions are studied. These two dimensional representations allow a quick visual observation of the data set under consideration. A combination of two popular mapping algorithms - Sammon's mean square error technique and the Triangulation method - is proposed to overcome the limitations in the individual algorithms. Some factors which described the goodness of a projection are described, and a comparison is made of six of these algorithms by running them on four data sets. The results obtained are calculated and their significance is discussed. GRA

N80-28082# National Bureau of Standards, Washington, D.C.
USING ANS FORTRAN Final Report
Gordon Lyon, ed., Frances E. Holberton, J. Larmouth (Salford Univ., England), and M. D. McIlroy (Bell Telephone Labs., Inc., Murray Hill, N.J.) Mar. 1980 109 p refs
(Grant NSF DCR-75-045443)
(PB80-168545; LC-80-600009) Avail: NTIS HC A06/MF A01 CSCL 09B

This FORTRAN volume presents, in order: a set of quick and clear reference charts for ANS FORTRAN 66 syntax; observations on using only standard FORTRAN 66 featurs; instructions on circumventing and extending FORTRAN 66 with the least harm; an appraisal of the new FORTRAN 77 in terms of FORTRAN 66 constructs. Although the chapters comprise much material that has appeared in other technical memoranda or published articles, heavily recast sections have been re-referenced. The four chapters address programmers concerned with FORTRAN transportability, managers engaged in programming standards, and other practitioners interested in system influences upon languages. Since the text touches upon several general programming aspects (input/out, storage allocation, storage lifetime and protection, control structures), the volume's appeal will extend beyond the immediate FORTRAN community. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N80-28083 California Univ., Berkeley.
COMPUTER NETWORKS: A MARTINGALE APPROACH Ph.D. Thesis
Jean Camille Walrand 1979 94 p
Avail: Univ. Microfilms Order No. 8014920

The results presented concern networks of queues which can be modelled as a continuous time Markov chain. An abstract model is developed and used to derive the filtering equations satisfied by the conditional probability distribution of the state of the network given the past of an observed set of flows. This approach yields a simple proof of the loop criterion for single class Jacksonian networks. A probabilistic interpretation of a necessary condition for a given flow in a multi-class Jacksonian network in equilibrium to be Poisson is also derived and used to show that the loop criterion does not apply to those networks. The properties of interconnected Markov chains are discussed and applied to mixed networks built from quasi-reversible nodes. It is shown that the quasi-reversibility and the product form for mixed networks follow from the results for open networks. The transit time of a customer on a path of a multiclass Jacksonian network is analysed. It is proved that if a path permits no overtaking, then the sojourn times of a customer in the nodes of that path are mutually independent and have the same distribution as in a single M/M/1 queue with same expected input rate. Examples show that the no overtaking condition cannot be relaxed in general. Dissert. Abstr.

N80-28084 State Univ. of New York at Buffalo.
THE INDEPENDENCE OF CONTROL STRUCTURES IN ABSTRACT PROGRAMMING SYSTEMS Ph.D. Thesis
Gregory Anthony Riccardi 1980 157 p
Avail: Univ. Microfilms Order No. 8016240

An instance of a control structure is a mapping which takes one or more programs into a new program whose behavior is based on that of the original programs. An instance of a control structure is effective if it is effectively computable. In order to study the interrelationships of control structures, abstract programming systems (numberings of the partial recursive functions) are considered, in which some control structures, effective or otherwise, are present, but others are not. The techniques of recursive function theory, including recursion theorems, priority arguments, and Blum complexity theory to prove the independence of certain control structures in abstract programming systems are discussed. For example, the following results were obtained. In effective numberings of the partial recursive functions, the one-one effective Kleene recursion theorem and the one-one effective (partial) if-then-else control structure are independent, but together, they yield all effective control structures. In any effective numbering, the effective Kleene form of the double recursion theorem yields all effective control structures. In effective numberings, the effective Rogers' fixed point form of the recursion theorem need not yield the control structure delay, effective or otherwise; hence, it does not yield the Kleene form of the recursion theorem. Dissert. Abstr.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N80-28085 Ohio State Univ., Columbus.
TIME-VARYING QUEUES REQUIRING SECONDARY SERVICE MECHANISMS FOR PRIMARY SERVERS Ph.D. Thesis
James Joseph Mager 1980 232 p
Avail: Univ. Microfilms Order No. 8015902

These systems involve customers being served by primary servers. However, after an initial service phase, the primary servers may require the use of secondary servers in order to serve the customer. This differs from the general network problem in that the primary server accompanies the customer (or his request) to the second system. The primary servers may have to wait, along with the customer of his request, for a secondary server to be free. A third phase of service may be provided by the primary servers after consultation with secondary servers. Both system A and system B are studied under time-varying arrival and service rates as well as time-varying primary and secondary service conditions. Arrival and service rates are approximated as fitted step functions. This makes these parameters constant over each interval of time. Dissert. Abstr.

N80-28086 Purdue Univ., Lafayette, Ind.
APPROXIMATE SOLUTIONS OF QUEUEING NETWORK MODELS OF COMPUTER SYSTEMS Ph.D. Thesis
Gianfranco Balbo 1979 408 p
Avail: Univ. Microfilms Order No. 8015424

Queueing network models of current computing systems are often too complex to satisfy the decomposability conditions which yield exact analytical solutions. Approximation methods for the solution of nondecomposable queueing network models of computer systems are discussed. The objective of these approximation methods is to adjust the parameters of a product form model in search of a best fit to the original system. It was discovered that corresponding to an arbitrary queueing network, there is an equivalent decomposable model whose queue length distributions are identical to those of the original system. This result means that product form based approximation methods

are, in principle, perfectly accurate, i.e., it assures the existence of an equivalent decomposable model sought by these techniques. The equivalence principle produces also a clearer understanding of existing approximation schemes and leads to improvements. Existing approximation methods and their variations are compared using a benchmark of 24 models representing a wide range of behaviors. Patterns of good and poor behavior are revealed for each one of these techniques. Dissert. Abstr.

N80-28087 Purdue Univ., Lafayette, Ind.
THE OPTIMIZATION OF QUERY PROCESSING ON DISTRIBUTED DATABASE SYSTEMS Ph.D. Thesis
Alan Raymond Hevner 1979 276 p
Avail: Univ. Microfilms Order No. 8015464

A detailed cost model of distributed query processing is developed and two optimization objectives, response time and total time are defined. The problem of finding a minimal cost processing strategy for any given distributed query is proved to be NP-hard. For a special class of queries, optimization algorithms are presented that derive minimal response time and minimal total time processing strategies. The techniques found in these optimal algorithms are used as a basis to develop effective heuristics that find efficient processing strategies for general queries. The heuristic algorithms, Algorithm GENERAL and Algorithm FAST, compare favorably with other proposed optimization algorithms in terms of complexity and quality of derived processing strategies. To evaluate the performance of distributed query optimization methods in a multiprocessing environment, a hybrid simulation model of a distributed base system is designed. The results of two query studies using the model show the importance of optimizing distributed queries. The relative performance of several proposed optimization algorithms is seen to be similar. Dissert. Abstr.

N80-28088 Purdue Univ., Lafayette, Ind.
VARIANCE REDUCTION TECHNIQUES FOR THE SIMULATION OF QUEUEING NETWORKS Ph.D. Thesis
James Reed Wilson 1979 212 p
Avail: Univ. Microfilms Order No. 8015542

The aims of this research are the formulation, implementation, and experimental assessment of procedures for applying selected combinations of a variance reduction technique (VRT) together with a confidence interval estimation technique (CIET) in the simulation of queueing networks. These procedures are designed to improve the efficiency of system performance estimators derived from a simulation experiment by exploiting auxiliary information contained in concomitant variables that are observed during the course of the experiment. For this purpose, a class of standardized service time variates are defined on the work stations of a queueing network. A version of the central limit theorem is established for these standardized variates in the context of a general class of regenerative queueing networks. This result constitutes the foundation for the development of post stratified sampling schemes as well as control variate schemes which are specially adapted to CIETs based on independent replications and on the theory of regenerative stochastic processes. The validation of these four VRT/CIET combinations is performed in an analytically tractable closed Jackson queueing system. The evaluation phase is carried out in three similar systems incorporating real-world features that are difficult or impossible to treat analytically; these features include priority scheduling, open and closed customer classes, general service times, and blocking due to capacity constraints. On the basis of the experimental results, guidelines are formulated for the effective application of the developed procedures in practical queueing simulations.
Dissert. Abstr.

N80-28089# Brown Univ., Providence, R. I. Div. of Engineering.
CONTROL OF NONLINEAR SYSTEMS Final Progress Report, 1 Jan. 1975 - 31 Dec 1979
Allan E. Pearson 26 Feb. 1980 22 p refs
(Grant AF-AFOSR-2793-75; AF Proj. 2304)
(AD-A083963; AFOSR-80-0252TR; FPR-5) Avail: NTIS HC A02/MF A01 CSCL 12/1

The research falls under six main categories: feedback stabilization methods for linear systems, including time varying, discrete, continuous, differential-delay and linear systems subject to average power constraints; controllability for a class of nonlinear systems; minimum energy regulators for commutative bilinear systems; control laws for certain aerospace applications; least squares parameter identification for linear and nonlinear systems; and signal reconstruction. These results are summarized for each catagory. GRA

N80-28090# Wisconsin Univ. - Madison. Mathematics Research Center.
ON HOMOGENEITY AND ON-LINE-OFF-LINE BEHAVIOR IN M/G/1 QUEUEING SYSTEMS
Raymond M. Bryant Feb. 1980 42 p refs
(Contract DAAG29-75-C-0024)
(AD-A083827; MRC-TSR-2045) Avail: NTIS HC A03/MF A01 CSCL 09/2

Operational analysis replaces certain classical queueing theory assumptions. We also state dual results for inter-arrival times in G/M/1. Finally, we consider the relationship between the operational quantities S(n) and the mean service time in M/G/1. This relationship is shown to depend on the form of the service time distribution. It follows that using operational analysis to predict the performance of an M/G/1 queueing system will be most successful when the service time is exponential. Simulation evidence is presented which supports this claim. GRA

N80-28091# Adaptronics, Inc., McLean, Va.
INVESTIGATION INTO ADAPTIVE CONTROL OF A SLIP-CAST, REACTION-BONDED SILICON-NITRIDE PROCESS VIA ADAPTIVE LEARNING NETWORK MODELING Final Technical Report, 31 Jan. - 30 Sep. 1979
Dixon Cleveland, Peter M. Garafola, Basil A. Decina, and Anthony N. Muccairdi 30 Nov. 1979 97 p refs
(Contract MDA903-79-C-0186; DARPA Order 3799)
(AD-A083730; ADI-REF-542) Avail: NTIS HC A05/MF A01 CSCL 07/1

A program was conducted to model the modulus of rupture (MOR) strength using Adaptive Learning Networks (ALN's) for aircraft engine components produced by a slip-cast, reaction-bonded, silicon-nitride production process. The primary objectives of the work were to identify key process variables and to predict optimum values for those variables as a guide for further experimentation. Nonlinear models have been synthesized that predict MOR with an average error of about 4 ksi over a range from 18.6 to 47.8. The manufacturing and analysis work done to date has demonstrated the feasibility of modeling the slip-cast RBSN process with the Adaptive Learning Network methodology and is viewed as the first iteration in the optimization procedure which is ultimately aimed at finding those manufacturing conditions which will produce the strongest, most consistent material strengths. GRA

N80-28092# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
PROCEDURAL ATTACHMENT
Luc Steels 30 Aug. 1979 22 p refs Sponsored in part by ARPA
(Contract N00014-75-C-0643)
(AD-A084637; AI-M-543) Avail: NTIS HC A02/MF A01 CSCL 09/4

A frame-based reasoning system is extended to deal with procedural attachment. Arguments are given why procedural attachment is needed in a symbolic reasoner. The notion of an infinitary concept is introduced. Conventions for representing procedures and a control structure regulating their execution is discussed. Examples from electrical engineering and music illustrate arithmetic constraints and constraints over properties of strings and sequences. GRA

N80-28093# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
USING PARALLEL PROCESSING FOR PROBLEM SOLVING
William A. Kornfeld Dec. 1979 49 p refs
(Contract N00014-75-C-0522)
(AD-A084638; AI-M-561) Avail: NTIS HC A03/MF A01 CSCL 09/4

Parallel processing as a conceptual aid in the design of programs for problem solving applications is developed. A

pattern-directed invocation language known as ETHER is introduced. ETHER embodies two notions in language design: activities and viewpoints. Activities are the basic parallel processing primitive. Different goals of the system can be pursued in parallel by placing them in separate activities. Language primitives are provided for manipulating running activities. Viewpoints are a generalization of context mechanisms and serve as a device for representing multiple world models. A number of problem solving schemes are developed making use of viewpoints and activities. It will be demonstrated that many kinds of heuristic search that are commonly implemented using backtracking can be reformulated to use parallel processing with advantage in control over the problem solving behavior. The semantics of ETHER are such that things as deadlock and race conditions that plague many languages for parallel processing cannot occur. The programs presented are quite simple to understand. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-28094 Kansas State Univ., Manhattan.
COLLOCATION METHODS FOR ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS Ph.D. Thesis
Glen W. Wittekind 1979 86 p
Avail: Univ. Microfilms Order No. 8015279

Collocation methods are presented for solving elliptic partial differential equations defined over a rectangular region. The approximating space is the tensor product of two piecewise polynomial spaces, each of C(1) continuity and arbitrary order. The theory and computational results indicate that the C(1) continuity with Gauss-Legendre collocation points has a distinct advantage over other choices. Dissert. Abstr.

N80-28095 Purdue Univ., Lafayette, Ind.
STRUCTURAL PARAMETER IDENTIFICATION OF MEMBER CHARACTERISTICS IN A FINITE ELEMENT MODEL Ph.D. Thesis
James Kimberly Sprandel 1979 487 p
Avail: Univ. Microfilms Order No. 8015522

A methodology developed to identify member characteristics in a general, user definable finite element model for which joint characteristics may be explicitly modeled. Bayes parameter estimates were obtained using time domain response data from either forced vibration, imposed base motion or snapback testing. The structural excitation was measured and interval estimates were obtained. Dissert. Abstr.

N80-28096*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE PRIMER VECTOR IN LINEAR, RELATIVE-MOTION EQUATIONS
Jan. 1980 28 p refs
(NASA-TM-81111; JSC-16332) Avail: NTIS HC A03/MF A01 CSCL 12A

Primer vector theory is used in analyzing a set of linear, relative-motion equations - the Clohessy-Wiltshire equations - to determine the criteria and necessary conditions for an optimal, N-impulse trajectory. Since the state vector for these equations is defined in terms of a linear system of ordinary differential equations, all fundamental relations defining the solution of the state and costate equations, and the necessary conditions for optimality, can be expressed in terms of elementary functions. The analysis develops the analytical criteria for improving a solution by (1) moving any dependent or independent variable in the initial and/or final orbit, and (2) adding intermediate impulses. If these criteria are violated, the theory establishes a sufficient number of analytical equations. The subsequent satisfaction of these equations will result in the optimal position vectors and times of an N-impulse trajectory. The solution is examined for the specific boundary conditions of (1) fixed-end conditions, two-impulse, and time-open transfer; (2) an orbit-to-orbit transfer; and (3) a generalized rendezvous problem. A sequence of rendezvous problems is solved to illustrate the analysis and the computational procedure. Author

N80-28097# Naval Research Lab., Washington, D. C. Lab. for Computational Physics.
CHEMEQ: A SUBROUTINE FOR SOLVING STIFF ORDINARY DIFFERENTIAL EQUATIONS Interim Report
T. R. Young, Jr. 26 Feb. 1980 50 p refs
(zf43451001)
(AD-A083545; AD-E000395; NRL-MR-4091) Avail: NTIS HC A03/MF A01 CSCL 09/2

A FORTRAN subroutine (CHEMEQ) which employs the Selected Asymptotic Integration Method (SAIM) for solving the stiff ordinary differential equations associated with reactive flow problems is described and documented. The SAIM algorithm identifies the stiff equations for treatment with a stiffly stable method. The remaining equations are treated with a standard classical method. The algorithm is a very low-overhead method which is particularly efficient when coupled with fluid dynamic calculations. It also gives significant reductions in computational costs for model development. The algorithm, its implementation, the FORTRAN code, the internal variables, and the argument lists are discussed and documented. The application of CHEMEQ to a test problem is also provided as an example. GRA

N80-28098# Wisconsin Univ. - Madison. Mathematics Research Center.
COMPUTER CALCULATION OF MECHANISMS INVOLVING INTERMITTENT MOTIONS
B. Noble and H. S. Hungs Dec. 1979 43 p refs
(Contract DAAG29-75-C-0024)
(AD-A083809; MRC-TSR-2026) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper deals with a simple computational approach to the analysis of dynamical systems involving intermittent motion in which the velocities involved can be discontinuous due to impulsive forces, impact, mass capture, and mass release. The sequence of these events may not be known ahead of time, and may in fact be one of the things we wish the computer to determine. The dynamical equations are formulated using a logical function method due to P. Ehle. The resulting system of ordinary differential equations with discontinuous coefficients is integrated using a standard computer code in regions where the coefficients are continuous. When discontinuities occur, jump conditions across the discontinuity are used to express the new velocities in terms of the old, and the ordinary differential equation solver is simply restarted with new initial conditions. To illustrate the simplicity of the approach, the method is applied to a dynamical system of ten masses considered by Ehle. The computer code and numerical results are included. GRA

N80-28099# Wisconsin Univ. - Madison. Mathematics Research Center.
THE BOLTZMAN EQUATION WITH A SOFT POTENTIAL. PART 2: NONLINEAR, SPATIALLY-PERIODIC
Russel Caflisch Jan. 1980 28 p refs
(Contract DAAG29-75-C-0024; Grants NSF MCS-78-09525; NSF MCS-78-07039)
(AD-A083813; MRC-TSR-2031-PT-2) Avail: NTIS HC A03/MF A01 CSCL 12/1

The results of part 1 are extended to include linear spatially periodic problems - solutions of the initial value are shown to exist and decay like exp(lambda (t to the beta power)). Then the full nonlinear Boltzmann equation with a soft potential is solved for initial data close to equilibrium. The nonlinearity is treated as a perturbation of the linear problem, and the equation is solved by iteration. GRA

N80-28100# Wisconsin Univ. - Madison. Mathematics Research Center.
FORCED OSCILLATIONS OF NONLINEAR HAMILTONIAN SYSTEMS, 2
Ivar Ekeland Dec. 1979 26 p refs
(Contract DAAG29-75-C-0024)
(AD-A083812; MRC-TSR-2030) Avail: NTIS HC A03/MF A01 CSCL 12/1

We study periodic solutions of the nonlinear Hamiltonian system with n degrees of freedom, the Hamiltonian H being

convex and super quadratic in both variables, and the forcing terms being T-periodic with mean value zero. We prove that, if these forcing terms lie within bounds which we explicitly compute, system (H) has some T-periodic solution, which we also locate explicitly. GRA

N80-28101# Wisconsin Univ. - Milwaukee. Mathematics Research Center.

COINCIDENT BIFURCATION OF EQUILIBRIUM AND PERIODIC SOLUTIONS OF EVOLUTION EQUATIONS Technical Summary Report

Michael Shearer Dec. 1979 27 p refs
(Contract DAAG29-75-C-0024)
(AD-A083810; MRC-TSR-2027) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Bifurcation of equilibrium and periodic solutions of nonlinear evolution equations is considered in the neighbourhood of an equilibrium solution for which the corresponding linear problem admits both non-zero equilibrium and non-constant periodic solutions. These solutions of the linear problem are related to those of the nonlinear equation by deriving bifurcation equations possessing a simple symmetry property. This results in a simplification of the bifurcation analysis, illustrated by a discussion of two important special cases exhibiting secondary bifurcation of periodic solutions. GRA

N80-28102# Wisconsin Univ. - Madison. Mathematics Research Center.

HIGH ORDER DIFFERENCE METHODS FOR QUASILINEAR ELLIPTIC BOUNDARY VALUE PROBLEMS ON GENERAL REGIONS

Klaus Boehmer Feb. 1980 47 p refs
(Contract DAAG29-75-C-0024)
(AD-A083824; MRC-TSR-2042) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Stability and convergence for a difference method for quasilinear elliptic boundary value problems are proved. Asymptotic expansions of the discretization error, basic for Richardson extrapolation, are established. The general theory of discrete Newton methods and iterated defect corrections via neighboring problems and Pereyra's deferred corrections are used to derive different high order methods. Some special cases and computational problems are pointed out and numerical tests are included. GRA

N80-28103# North Carolina Univ. at Chapel Hill. Inst. of Statistics.

EXTREME VALUE THEORY FOR CONTINUOUS PARAMETER STATIONARY PROCESSES

M. R. Leadbetter Mar. 1980 42 p refs
(Contract N00014-75-C-0809)
(AD-A083802; MM-SER-1276) Avail: NTIS
HC A03/MF A01 CSCL 12/1

The central distributional results of classical extreme value theory are obtained, under appropriate dependence restrictions, for maxima of continuous parameter stochastic processes. In particular we prove the basic result (here called Gnedenko's Theorem) concerning the existence of just three types of non-degenerate limiting distributions in such cases, and give necessary and sufficient conditions for each to apply. The development relies, in part, on the corresponding known theory for stationary sequences. The general theory given does not finiteness of the number of upcrossings of any level x. However when the number per unit time is a.s. finite and has a finite mean mu(x), it is found that the classical criteria for domains of attraction apply when mu(x) is used in lieu of the tail of the marginal distribution function. The theory is specialized to this case and applied to give the general known results for stationary normal processes (for which mu(x) may or may not be finite). A general Poisson convergence theorem is given for high level upcrossings, together with its implications for the asymptotic distributions of r-th local maxima. GRA

N80-28104# Wisconsin Univ. - Madison. Mathematics Research Center.

A SIMPLE DERIVATION OF GLASSMAN'S GENERAL N FAST FOURIER TRANSFORM Technical Summary Report

Warren E. Ferguson, Jr. Dec. 1979 21 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-09525)
(AD-A083811; MRC-TSR-2029) Avail: NTIS
HC A02/MF A01 CSCL 12/1

A simple derivation of Glassman's general N fast Fourier transform, and corresponding FORTRAN program, is presented. This fast Fourier transform is based upon a representation of the discrete Fourier transform matrix as a product of sparse matrices. GRA

N80-28105# Wisconsin Univ. - Madison. Mathematics Research Center.

CONVERGENT APPROXIMATIONS IN PARABOLIC VARIATIONALLY INEQUALITIES. 1: ONE PHASE STEFAN PROBLEMS Technical Summary Report

Joseph W. Jerome Jan. 1980 25 p refs
(Contract DAAG29-75-C-0024)
(AD-A083814; MRC-TSR-2032) Avail: NTIS
HC A02/MF A01 CSCL 12/1

Many physical phenomena are modelled by inequalities rather than equations. In this report we examine a dynamic, or parabolic inequality, which characterizes the change of phase of a substance, e.g., ice melting, under certain assumptions. We obtain rates of convergence for certain approximation schemes which separately discretize time and space. The rates, as well as one of the schemes, appear to constitute new results in a subject which is still rather undeveloped. Subsequent investigations are also contemplated for inequalities related to different physical models. GRA

N80-28106# Wisconsin Univ. - Madison. Mathematics Research Center.

EQUILIBRIA OF THE CURVATURE FUNCTIONAL AND MANIFOLDS OF NONLINEAR INTERPOLATING SPLINE CURVES

Michael Golomb and Joseph W. Jerome Nov. 1979 70 p refs
(Contract DAAG29-75-C-0024; Grant NSF MPS-74-02292)
(AD-A083807; MRC-TSR-2024) Avail: NTIS
HC A04/MF A01 CSCL 12/1

The mathematical formulation of curve fitting by mechanical splines, i.e., thin, flexible, elastic beams passing through freely rotating sleeves anchored at fixed locations, is studied in this report. These are called elastica or nonlinear spline curves. As contrasted with the mathematically idealized splines, which have proven to be of considerable utility and concerning which much information is available, the nonlinear splines are relatively poorly understood. The writers are attempting to understand and systematically construct these curves. Computer graphics obtained by other workers suggest remarkable efficiency of the elastica for curve fitting. This is perhaps not too surprising since the nonlinear spline represents an equilibrium position of a thin beam. GRA

N80-28107# Wisconsin Univ. - Madison. Mathematics Research Center.

A NONLINEAR VOLTERRA EQUATION IN VARIABLE DOMAIN

Hedy Attouch and Alain Damlamian Dec. 1979 11 p refs
(Contract DAAG29-75-C-0024)
(AD-A083829; MRC-TSR-2028) Avail: NTIS
HC A02/MF A01 CSCL 12/1

We prove the existence and uniqueness of a strong solution of a nonlinear heat flow equation governing the temperature in a homogeneous material with memory when the temperature outside of a smooth time dependent domain Omega(t) is prescribed. GRA

N80-28108# Wisconsin Univ. - Madison. Mathematics Research Center.

CONTINGENT DERIVATIVES OF SET-VALUED MAPS AND SOLUTIONS TO NONLINEAR INCLUSIONS AND DIFFERENTIAL INCLUSIONS

Jean Pierre Aubin Feb. 1980 92 p refs
(Contract DAAG29-75-C-0024)
(AD-A083826; MRC-TSR-2044) Avail: NTIS
HC A05/MF A01 CSCL 12/1

We use the Bouligand contingent cone to a subset K of a Hilbert space at x an element of K for defining contingent

derivatives of a set-valued map, whose graphs are the contingent cones to the graph of this map, as well as the upper contingent derivatives of a real valued function. We develop a calculus of these concepts and show how they are involved in optimization problems solving equations f(x) = 0 and/or inclusions 0 = F(x). They also play a fundamental role for generalizing the Nagumo theorem on flow invariance and for generalizing the concept of Liapunov functions for differential equations and/or differential inclusions. GRA

N80-28109# Wisconsin Univ. - Madison. Mathematics Research Center.

OPTIMAL SIMPLEX TABLEAU CHARACTERIZATION OF UNIQUE AND BOUNDED SOLUTIONS OF LINEAR PROGRAMS

O. L. Mangasarian Jan. 1980 20 p refs

(Contract DAAG29-75-C-0024)

(AD-A083816; MRC-TSR-2034) Avail: NTIS HC A02/MF A01 CSCL 12/1

Uniqueness and boundedness of solutions of linear programs are characterized in terms of an optimal simplex tableau. Let M denote the submatrix in an optimal simplex tableau with columns corresponding to degenerate optimal dual basic variables. A primal optimal solution is unique *if* and only *if* there exists a nonvacuous nonnegative linear combination of the rows of M corresponding to degenerate optimal primal basic variables which is positive. The set of primal optimal solutions is bounded *if* and only *if* there exists a nonnegative linear combination of the rows of M which is positive. When M is empty the primal optimal solution is unique. GRA

N80-28110# Wisconsin Univ. - Madison. Mathematics Research Center.

NEW ALGORITHMS FOR NONLINEAR LEAST SQUARES AND BAYESIAN PARAMETER ESTIMATION

Warren E. Stewart and Jan P. Sorensen Feb. 1980 27 p refs

(Contract DAAG29-75-C-0024; Grant NSF ENG-76-24368)

(AD-A083819; MRC-TSR-2037) Avail: NTIS HC A03/MF A01 CSCL 12/1

Some new algorithms are presented for fitting mathematical models to multiple-response experiments. These algorithms give estimates of the parameters in a user-defined predictor model, and also estimate the parameters of a Gaussian model of the observational error distribution. The development is based on Bayes' theorem, and provides a natural extension of known least-squares estimation methods. Allowance is made for missing values of responses, which occur frequently in practical work. GRA

N80-28111# Wisconsin Univ. - Madison. Mathematics Research Center.

MOVING WEIGHTED AVERAGE SMOOTHING EXTENDED TO THE EXTREMITIES OF THE DATA, REVISION

T. N. E. Greenville Nov. 1979 55 p refs Revised

(Contract DAAG29-75-C-0024)

(AD-A083808; MRC-TSR-2025-Rev) Avail: NTIS HC A04/MF A01 CSCL 12/1

The use of a symmetrical moving weighted average of 2m - 1 terms to smooth equally spaced observations of a function of one variable does not yield smoothed values of the first m and the last m observations, unless additional data beyond the range of the original observations are available. By means of analogies to the Whittaker smoothing process and some related mathematical concepts, a natural method is developed for extending the smoothing to the extremities of the data as a single overall matrix vector operation having a well defined structure, rather than as something extra grafted on at the ends. GRA

N80-28112# Maryland Univ., College Park. Dept. of Computer Science.

REGION REPRESENTATION: QUADTREE-TO-RASTER CONVERSION

Hanan Samet Jun. 1979 28 p refs

(Contract DAAG53-76-C-0138; DARPA Order 3206)

(AD-A084288; TR-768) Avail: NTIS HC A03/MF A01 CSCL 12/1

An algorithm is presented for obtaining a raster representation for an image given its quadtree. For each raster row the algorithm visits the appropriate nodes in the quadtree and, for each such node, outputs a run of length equal to the width of the corresponding block. Each block's node is visited as many times as it is high. Analysis of the algorithm reveals that its execution time is proportional to the sum of the heights of the blocks comprising the image. The total number of terminal and non-terminal nodes visited by the algorithm is also computed and shown to be a function of the number of maximal black and white blocks in the image. This means that the algorithm's execution time is directly proportional to the complexity of the image. GRA

N80-28113# Maryland Univ., College Park. Computer Science Center.

COMPUTING THE EULER NUMBER OF IMAGE FROM ITS QUADTREE

Charles R. Dyer May 1979 17 p refs

(Contract DAAG53-76-C-0138; DARPA Order 3206)

(AD-A084289; TR-769) Avail: NTIS HC A02/MF A01 CSCL 12/1

An algorithm is presented which computes the Euler number, i.e., the number of components minus the number of holes, of a binary image represented by the quadtree. The local property counting techniques used with an array representation are generalized to counting local node configurations in a quadtree. The average worst case running time of the algorithm is proportional to the product of the number of nodes representing the components and the logarithm of the image diameter. GRA

N80-28114# Maryland Univ., College Park. Dept. of Computer Science.

A DISTANCE TRANSFORM FOR IMAGES REPRESENTED BY QUADTREES

Hanan Samet Jul. 1979 41 p refs

(Contract DAAG53-76-C-0138; DARPA Order 3206)

(AD-A084290; TR-780) Avail: NTIS HC A03/MF A01 CSCL 12/1

The concept of distance used in binary array representations of images is adapted to a quadtree representation. The Chessboard distance metric is shown to be particularly suitable for the quadtree. A Chessboard distance transform for a quadtree is defined as the minimum distance in the plane from each BLACK node to the border of a WHITE node. An algorithm is presented which computes this transform by only examining the BLACK node's adjacent and abutting neighbors and their progeny. Analysis of the algorithm shows that its average execution time is proportional to the number of leaf nodes in the quadtree. GRA

N80-28115# Maryland Univ., College Park. Computer Vision Lab.

FITTING MOSAIC MODELS TO TEXTURES

Narendra Ahuja and Azriel Rosenfeld Jul. 1979 33 p refs

(Contract DAAG53-76-C-0138; DARPA Order 3206)

(AD-A084291; TR-789) Avail: NTIS HC A03/MF A01 CSCL 12/1

Mosaic image models are defined by random geometric processes. Various properties of the patterns generated by such models can be predicted. Using these properties, we can fit the models to real images, and thus obtain insights into the structure of these images. GRA

N80-28116# Maryland Univ., College Park. Computer Vision Lab.

SHAPE SEGMENTATION USING RELAXATION, 2

Wallace S. Rutkowski Jul. 1979 26 p refs

(Contract DAAG53-76-C-0138; DARPA Order 3206)

(AD-A084292; TR-793) Avail: NTIS HC A03/MF A01 CSCL 12/1

The work begun in (1) on the application of relaxation to ambiguous shape segmentation is extended to include curve linking and gap filling. A chain coded input image is broken into segments based on a measure of local curvature. Gap completions linking pairs of segments are then proposed and represented in a graph structure. A second graph, whose nodes consist of paths in the above graph, is constructed, and the nodes of the second graph are probabilistically classified as various object parts.

Relaxation is then applied to increase the probability of mutually supporting classifications, and decrease the probability of unsupported decisions. A modified relaxation process using information about the size, spatial position, and orientation of the object parts yielded a high degree of disambiguation. GRA

N80-28117# Maryland Univ., College Park. Dept. of Computer Science.
REGION REPRESENTATION: QUADTREES FROM BINARY ARRAYS
Hanan Samet May 1979 14 p refs
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A084287; TR-767) Avail: NTIS HC A02/MF A01 CSCL 12/1

An algorithm is presented for constructing a quadtree from the array representation of a binary image. The algorithm examines each pixel in the image once and only once. In addition, as the tree is constructed, only maximal sized nodes are ever created. Thus the algorithm never requires temporary nodes. The execution time of the algorithm is equal to the number of pixels in the image. The amount of space, in addition to that necessary for the final quadtree, is proportional to the log of the image diameter. GRA

N80-28118# Minnesota Univ., St. Paul. Dept. of Applied Statistics.
GENERALIZING THE ITERATIVE PROPORTIONAL FITTING PROCEDURE
Michael M. Meyer Apr. 1980 44 p refs
(Contract N00014-78-C-0151)
(AD-A084429; TR-371) Avail: NTIS HC A03/MF A01 CSCL 12/1

The Iterative Proportional Fitting Procedure (IPFP) can be viewed as a method for maximizing the likelihood for certain loglinear models or equivalently for minimizing the Kullback-Leibler information between two probability densities. Both of these viewpoints lead to natural generalizations of the classical IPFP. We examine the generalizations, and with the aid of the theory, explore a practical example of expanding a contingency table. GRA

N80-28119# North Carolina Univ. at Chapel Hill. Dept. of Statistics.
DEPENDENT RELEVATIONS
N. L. Johnson Research Triangle Park, N.C. Army Res. Office Mar. 1980 13 p refs
(Contract DAAG29-77-C-0035; Grant AF-AFOSR-3673-78)
(AD-A084543; MMS-1273; ARO-14778.10-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

Krakowski (1973) introduced the concept of the relevation, which is the conditional distribution of a random variable sub 2, given that it exceeds an independent random variable x sub 1. This is relevant to failure time distributions when replacement is made from an aging stock. We develop analysis appropriate to relevation for dependent variables, and suggest it might be relevant if there is batch-to-batch variation, producing association between lifetimes of initial and replacement components. GRA

N80-28120# Texas A&M Univ., College Station. Inst. of Statistics.
MODERN EMPIRICAL STATISTICAL SPECTRAL ANALYSIS
Emanuel Parzen May 1980 29 p refs
(Contract N00014-78-C-0599)
(AD-A084142; TR-N-12) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper has two aims: to provide perspectives on the diverse paths of analysis which are available in 1980 to estimate the spectrum of an observed time series; and to describe proposals for optimal statistical spectral estimation procedures which combine autoregressive spectral estimators and log spectral estimators. It is proposed that empirical statistical spectral analysis should be an adaptive procedure for forming an iterative spectral estimator (an iterative estimator is one composed of estimators obtained in different steps of the analysis). There are three parts: (1) Basic concepts of time series spectral analysis; (2) entropy distances, autoregressive spectral estimators and log spectral estimators; and (3) an outline of empirical spectral analysis. GRA

N80-28121# Texas Univ. at Austin. Center for Cybernetic Studies.
GENERALIZED NETWORK APPROACHES FOR SOLVING LEAST ABSOLUTE VALUE AND TCHEBYCHEFF REGRESSION PROBLEMS
Darwin Klingman and John Mote (Analysis, Research and Computation, Inc., Austin, Tex.) Dec. 1979 42 p refs
(Contract N00014-78-C-0222)
(AD-A084284; CCS-365) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper studies two classes of bivariate regression analysis problems that can be formulated and solved quite efficiently as generalized network flow problems. GRA

N80-28122# Virginia Univ., Charlottesville. Dept. of Applied Mathematics and Computer Science.
ANALYSIS OF COMPUTATIONAL METHODS FOR NONLINEAR PARABOLIC DIFFERENTIAL SYSTEMS Final Report
R. Leonard Brown Apr. 1980 59 p refs
(Grant AF-AFOSR-0024-79)
(AD-A084236; UVA/525629/AMC80/101; AFOSR-80-0340TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

Many important problems in fluid dynamics, among other areas, are modeled by nonlinear parabolic differential systems with initial values given in one independent variable, x, and boundary values in the remaining dependent variables. Hyperbolic systems can sometimes be treated as a special case. For example, the inviscid flow case of the Navier-Stokes equations is a hyperbolic system, while the viscous flow case is elliptical. A survey of currently used numerical methods is in Richtmeyer and Morton. In subsonic flow cases, the nonlinear terms are small enough to be ignored, but these terms must be included in supersonic and hypersonic flow. These numerical calculations usually involve a finite difference mesh over the boundary value problem variables, resulting in a space discretization matrix equation which for the nonlinear system varies at each step in x, the independent variable representing time in the dynamic case or one of the space variable for the steady state case. Then this nonlinear system is solved as an initial value problem in x. The initial value problem is usually solved by a one step implicit method for reasons of cost and stability. Some methods based on finite element methods for the boundary value problem can be used, but successful methods are only available for the linear cases, such as subsonic flow problem. GRA

N80-28123# Naval Research Lab., Washington, D. C.
DIRECT ELLIPTIC EQUATION SOLVERS WITH LOW MEMORY REQUIREMENTS
M. R. Schoeberl 13 Mar. 1980 21 p refs
(RR0330244)
(AD-A084557; AD-E000406; NRL-MR-4191) Avail: NTIS HC A02/MF A01 CSCL 12/1

Several simple modifications of the Lindzen-Kuo, Gaussian elimination algorithms for solving elliptic differential equations are derived. These modifications greatly decrease the auxiliary memory requirements thus making this method suitable for solving elliptic equations over large grids. GRA

N80-28124# Lincoln Lab., Mass. Inst. of Tech., Lexington.
APPLICATION OF LINEAR PREDICTION TO MULTICLASS SEQUENTIAL DISCRIMINATION
Charles W. Therrien 19 Dec. 1979 37 p refs
(Contract F19628-80-C-0002)
(AD-A084272; TN-1979-63; ESD-TR-308) Avail: NTIS HC A03/MF A01 CSCL 17/7

A linear predictive form of classifier is described for the sequential discrimination of target signatures. The classifier implements a Generalized Sequential Probability Ratio Test (GSPRT) which allows for multiple classes of target signatures. Forms of the classifier for both noncoherent and coherent signatures are described. Flow charts are included for convenience of implementation. GRA

N80-27341# Ferranti Ltd., Bracknell (England). Computer Systems.
APPLICATIONS OF MICROPROCESSORS IN AIR TRAFFIC
David L. Stoddart *In* AGARD *Air Traffic Management: Civil/Mil. Systems and Technol.* Feb. 1980 10 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-28125 California Univ., Berkeley.
RATES OF CONVERGENCE FOR ESTIMATION AND TESTING IN MULTINOMIAL DISTRIBUTIONS Ph.D. Thesis
Kenneth Henry Sutrick 1979 181 p
Avail: Univ. Microfilms Order No. 8014900

Various problems involving the multinormal distribution are presented. An asymptotic power comparison between the likelihood ratio test and a class of chi squares tests is demonstrated. An estimation of a single parameter is given and expansion for the estimators and their mean square error are given. It is shown that there are other estimation procedures which have the same properties as minimum chi square and maximum likelihood estimates. Dissert. Abstr.

N80-28126 Florida State Univ., Tallahassee.
AN INVESTIGATION OF OUTLIER DEFINITION AND THE IMPACT OF THE MASKING PHENOMENON ON SEVERAL STATISTICAL OUTLIER TESTS Ph.D. Thesis
Patricia Little Fisher 1980 165 p
Avail: Univ. Microfilms Order No. 8014123

The problem of statistical outliers is examined. Different possible approaches to outlier identification are discussed, and the highlights of the development of outlier tests and the competing methods of multiple outlier detection, consecutive and block procedures, are explained. The masking problem, which hinders effective application of the consecutive procedures, is described, as are several other problems which complicate the outlier issue for the research practitioner. Dissert. Abstr.

N80-28127 Maryland Univ., College Park.
A MONTE CARLO APPROACH TO THE SAMPLING ERROR OF ESTIMATES OF THE GENERALIZABILITY STATISTICS FROM A TWO FACET COMPLETELY CROSSED GENERALIZABILITY STUDY Ph.D. Thesis
James Anthony DiStefano 1979 159 p
Avail: Univ. Microfilms Order No. 8016348

A Monte Carlo approach was used to study the sampling error of estimates of the generalizability coefficient and errors DELTA and delta from a two facet (three factor) completely crossed generalizability study, systematically varying the number of levels of each facet sampled and the population variance component configuration. Estimates were obtained by the analysis of variance. All negative component estimates were set equal to zero. Generalizability coefficients computed with negative variances set equal to zero were compared with coefficients computed by including negative variance estimates. Ten variance component configurations were selected. Within each variance component, sampling error was investigated using eight (P,I,J) sampling plans. It is shown that much smaller sample sizes could be used in configurations having large persons components and small interactions. It was also shown that for sample sizes less than 100 generalizability coefficients computed with negative variance estimates unchanged provided a more accurate estimate of the universe value of the generalizability coefficient.
Dissert. Abstr.

N80-28128 North Carolina Univ. at Chapel Hill.
SAMPLING REPRESENTATIONS AND APPROXIMATIONS FOR CERTAIN FUNCTIONS AND STOCHASTIC PROCESSES Ph.D. Thesis
Muhammad Kamel Habib 1979 99 p
Avail: Univ. Microfilms Order No. 8014204

Finite sampling approximations are derived for certain functions and processes which are not bandlimited, as well as bounds on the approximation errors. Also derived are sampling representations for bounded linear operators acting on certain classes of bandlimited functions and processes; these representations enable one to reconstruct the image of a function (or a process) under a bounded linear operator using the samples of the function (or the process) rather than the samples of the image. Sampling representations for distributions and random distributions are obtained. Dissert. Abstr.

N80-28129 State Univ. of New York, Buffalo.
MODELING AND INVESTIGATION OF PERIODIC PHENOMENA USING TECHNIQUES OF TIME SERIES ANALYSIS Ph.D. Thesis
Jessica Pollner 1980 241 p
Avail: Univ. Microfilms Order No. 8016232

Periodic autoregressive models as a means of modeling and analyzing time series was investigated. The theory of both univariate and multivariate times series was applied and extended to periodic processes, with particular attention focused on autoregressive models. The periodic autoregressive model led to the consideration of estimators, easily implemented algorithms and data analytic applications. Regression models were proposed and investigated as additional model types for analyzing periodic processes. An attempt was made to extend the association of regression models and univariate autoregressive schemes to that of periodic autoregressions. Dissert. Abstr.

N80-28130 Temple Univ., Philadelphia, Pa.
ON PROBABILITY DISTRIBUTIONS INVOLVING THE STIRLING NUMBERS Ph.D. Thesis
Ramalingam Shanmugam 1979 68 p
Avail: Univ. Microfilms Order No. 8014511

The maximum likelihood and the minimum variance unbiased and the bayesian estimators of the poisson probabilities were compared. Expressions for the bias, and the mean square error were derived, and expressed in terms of the Stirling numbers of the second kind. All three estimators are shown to be consistent. Dissert. Abstr.

N80-28131 California Univ., Berkeley.
RECURSIVE ESTIMATION IN TIME SERIES MODELS Ph.D. Thesis
Knut Kristian Aase 1979 162 p
Avail: Univ. Microfilms Order No. 8014589

An adaptive estimation principle is considered for both standard and nonstandard time series models. General nonlinear, non-Markovian, continuous processes are considered and several optimality properties are shown to hold for the resulting estimator, using Ito's stochastic calculus. A number of applications are discussed, possible extensions are indicated, and Monte Carlo simulations are used throughout to guide the directions taken and to support the theoretical findings. Dissert. Abstr.

N80-28132# Missouri Univ. - Columbia. Dept. of Statistics.
MAXIMUM LIKELIHOOD ESTIMATION OF THE SURVIVAL FUNCTIONS OF STOCHASTICALLY ORDERED RANDOM VARIABLES
Richard L. Dykstra Mar. 1980 26 p refs
(Contract N00014-78-C-0655)
(AD-A083903; TR-91) Avail: NTIS HC A03/MF A01 CSCL 12/1

Many times populations exist which logically must satisfy a stochastic ordering requirement. Nevertheless, estimates of these populations may not bear out this stochastic ordering because of the inherent variability of the observations. This paper will consider the problem of finding maximum likelihood estimates of stochastically ordered survival functions for the cases (1) one survival being fixed in advance and (2) estimating both survival functions when the data includes censored observations. A numerical example is handled in detail to illustrate the solution to this problem. GRA

N80-28133# Wisconsin Univ. - Madison. Mathematics Research Center.
SINGULARLY PERTURBED EQUATIONS IN THE CRITICAL CASE

A. B. Vasileva and V. F. Butuzov Feb. 1980 161 p refs Transl. into ENGLISH from Russian monograph, 1978
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-00907)
(AD-A083821; MRC-TSR-2039) Avail: NTIS HC A08/MF A01 CSCL 12/1

This monograph is a sequel to the authors' work 'Asymptotic Expansions of Solutions of Singularly Perturbed Equations', Nauka, 1973. It considers cases in which the characteristic equation has zero roots. In the book many applications are given to concrete physical problems including a detailed examination of several problems in kinetics, in the theory of semiconductors, in numerical difference schemes, etc. The usual mathematical preparation of an engineer is sufficient for understanding the results. Author (GRA)

N80-28134# Minnesota Univ., St. Paul. Dept. of Applied Statistics.
CONTINGENCY TABLES
Stephen E. Fienberg Feb. 1980 32 p refs Submitted for publication
(Contract N00014-78-C-0600)
(AD-A084262; TR-369) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper is concerned primarily with the use of loglinear models for the analysis of contingency table data. An introduction to multivariate statistical analysis is presented and the topic is placed in an historical perspective. Examples which illustrate some of the methods of analysis are described. The basic statistical theory associated with maximum likelihood estimation and loglinear models is outlined and the results are applied to the examples. The paper concludes with a guide to some recent applications of loglinear and contingency table modelling, and to computer programs for contingency table analysis. GRA

N80-28135# Brown Univ., Providence, R. I. Center for Dynamical Systems.
OPTIMAL STATIONARY LINEAR CONTROL OF THE WIENER PROCESS Interim Report
Vaclav E. Benes (Bell Telephone Labs, Murray Hill) and Ioannis Karatzas (Columbia Univ.) 29 Feb. 1980 33 p refs Present at the Conf. on Stochastic Processes and Their Applications, Evanston, Ill., Aug. 1979
(Grant AF-AFOSR-3063-76; AF Proj. 2304)
(AD-A084350; AFOSR-80-0338TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper we consider the problem of stationary control of the stochastic differential equation where (W sub t) is a Wiener process on an underlying probability space. Two kinds of cost are involved in this problem. First, one pays Phi (zeta sub t) per unit time for being in the wrong state zeta sub t; secondly, one pays u sub t per unit time for using the control law u sub t. The control problem is to choose a law so as to minimize the average expected total cost. It is proved that the optimal law can be explicitly described and its performance characterized in terms of the cost function. GRA

N80-28136# Arizona State Univ., Tempe. Coll. of Education.
AN ANOMALY IN THE PEARSON PRODUCT-MOMENT CORRELATION COEFFICIENT Interim Report
Robert C. Haygood and Vernon S. Gerlach Dec. 1978 10 p refs
(Grant AF-AFOSR-2900-76; AF Proj. 2313)
(AD-A084354; TR-81229; AFOSR-80-0333TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

An anomalous condition in the use of the Pearson product-moment correlation coefficient is reported in which decreasing variance of one or both variables is associated with increased absolute value of the coefficient, contrary to popular expectation. The reasons for this are discussed, along with a recommendation for a change in the method of presenting restriction-of-range phenomena in statistical instruction. GRA

N80-28137# Naval Postgraduate School, Monterey, Calif.
A PREDICTION INTERVAL FOR A FIRST ORDER GAUSSIAN MARKOV PROCESS
Toke Jayachandran and T. S. Murthy Apr. 1980 25 p ref
(RR0000110)
(AD-A084094; NPS53-80-002) Avail: NTIS HC A02/MF A01 CSCL 12/1

A mathematical model of coupled heat and moisture flow in soils has been developed. The model includes algorithms for phase change of soil moisture and frost heave, and several types of boundary and initial conditions are permitted. The finite element method of weighted residuals Galerkin procedure was chosen to simulate the spatial regime and the Crank-Nicholson method was used for the time domain portion of the model. To facilitate evaluation of the model, the heat and moisture fluxes were essentially 'decoupled' moisture flux was then simulated accurately, as were heat flux and frost penetration. The coupled model was used to simulate frost penetration and frost heave in a laboratory test. Comparison of the simulated and experimental data illustrates the importance of unsaturated hydraulic conductivity. It is one parameter which is difficult to measure and for which only a few laboratory test results are available. Therefore, unsaturated hydraulic conductivities calculated in the computer model may be a significant source of error in calculations of frost heave. The algorithms incorporating effects of surcharge and overburden was evaluated. Time dependent frost penetration and frost heave in laboratory specimens were closely simulated with the model. GRA

N80-28138# Naval Postgraduate School, Monterey, Calif.
A GENERAL MIXTURE-TRUNCATION METHOD FOR GENERATING BIVARIATE RANDOM VARIABLES FROM UNIVARIATE GENERATORS M.S. Thesis
Myong Ho Shin (Korean Air Force) Mar. 1980 172 p refs
(AD-A084474) Avail: NTIS HC A08/MF A01 CSCL 12/1

This thesis deals with the generation of bivariate random variables with identical marginal distributions and specified correlation coefficients. Many schemes have been put forward for different cases; they almost always involve computing the inverse probability distribution of the marginal distributions or exploiting special properties of the random variables in question. A simple mixture-truncation method is put forward here to generate bivariate distributions with any marginal distribution from univariate generators. GRA

N80-28139# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Statistics.
RANDOM COVERAGE OF A CIRCLE WITH APPLICATION TO A SHADOWING PROBLEM
M. Yadin and S. Zacks 15 May 1980 23 p refs
(Contract N00014-80-C-0325; NR Proj. 042-276)
(AD-A084357; VPI-TR-1) Avail: NTIS HC A02/MF A01 CSCL 12/1

The coverage problem on the circle is considered from the shadowing process point of view. A random number of shadow arcs are distributed on a circle. The length of each arc is a random variable which depends on the random diameter of a shadowing disk and its random location. Formulas are derived for the numerical determination of the moments of the measure of vacancy of arcs on the circle. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-28140 California Univ., Berkeley.
A POINT MAPPING STUDY OF DYNAMICAL SYSTEMS Ph.D. Thesis
Henryk Flashner 1979 184 p
Avail: Univ. Microfilms Order No. 8014677

A method to obtain an approximation for period to period mapping of multidimensional periodic systems is proposed. It is shown that the method can be applied to a large class of dynamical systems governed by differential equations with periodically varying coefficients. The proposed method is based on the Runge-Kutta algorithm for solving a set of ordinary differential equations. The only limitation of the method is the size of computer memory needed to store the various terms of the point mapping. Computer programs implementing the proposed method to one and two degree of freedom systems are given. The programs

are used to compute the point mapping of two example dynamical systems with periodically varying coefficients. Application of the method to obtain an approximation of the Strutt diagram of the Mathieu equation is given. Dissert. Abstr.

N80-28141 California Univ., Berkeley.
A SYSTEMATIC APPROACH FOR THE DESIGN AND ANALYSIS OF DISTRIBUTED COMPUTER SYSTEMS Ph.D. Thesis
Gary Shiu-Fan Ho 1979 168 p
Avail: Univ. Microfilms Order No. 8014735

A systematic approach for the design and analysis of computer systems is presented. A top down development approach for computer systems, and some analysis techniques for system performance and system deadlocks are developed. Dissert. Abstr.

N80-28142 Illinois Univ. at Chicago Circle, Chicago.
ALGORITHMS FOR SOLVING SOME UNDISCOUNTED STOCHASTIC GAMES Ph.D. Thesis
Jerzy Andrzej Filar 1980 118 p
Avail: Univ. Microfilms Order No. 8014224

Zero-sum stochastic games are studied with finite state and action spaces in which payoffs are undiscounted. In fact, payoffs will be evaluated according to a limiting expected average criterion. Such a criterion is meaningful only if both players expect the game to continue indefinitely and if discounting of payoffs is inappropriate. All of the undiscounted games studied here are constrained by some natural restrictions on strategic possibilities of the players. In addition to being mathematically expedient, the assumptions made about the games studied are easily verifiable and preserve the competitive nature of undiscounted stochastic games. The following main results are presented: (1) A finite-step algorithm is given which solves any undiscounted stochastic game in which one player controls the transitions (i.e., probability transitions are functions of the actions of one player only). The value and optimal stationary strategies for both players can be found by this method. (2) For an undiscounted game in which payoffs and transition probabilities lie in the same ordered Archimedean field and in which one player controls transitions in some states while the other player controls transitions in remaining states, a constructive proof of the existence of the value and of optimal stationary strategies for both players is given. Dissert. Abstr.

N80-28143# Operating Systems, Inc., Woodland, Calif.
SATELLITE AND MISSILE DATA GENERATION FOR AIS Final Technical Report, 1 Sep. 1978 - 31 Aug. 1979
Georgette M. Silva and Christine A. Montgomery Griffiss AFB, N.Y. RADC Dec. 1979 194 p refs
(Contract F30602-78-C-0274; AF Proj. 4594)
(AD-A084326; OSI-R79-037; RADC-TR-79-314) Avail: NTIS HC A09/MF A01 CSCL 09/4

The effort described specifically addressed the problem of deriving indicator and descriptor data from the narrative text portions of a class of intelligence messages dealing with events related to missile and satellite launchings used for input to the Advanced Indicator System (AIS) data base. The introductory section briefly discusses the intelligence problem which OSI's event processing technology intends to solve, summarizes the technology developed under this contract, and presents the conclusions drawn on the basis of the results obtained. Section 2 offers a summary of OSI's methodological approach to the analysis and description of event reports. This methodology, initially developed on the basis of messages dealing with air activities, was, under this contract, extended to cover reports of events involving missile and satellite launchings and related events. Section 3 describes the Missile and Satellite domains, and presents the results of their analysis in terms of a domain definition. The discussion includes a characterization of the event report in terms of its component messages; a list of the message types encountered in the domains under consideration; a list of the event types identified together with their descriptor system, and a definition of the sublanguage in terms of its vocabulary and syntax. Section 4 focuses on the implementation of OSI's message text analysis system, MATRES II. It briefly reviews the principles underlying OSI's event processing technology and offers an overview of MATRES. GRA

N80-28144# Massachusetts Inst. of Tech., Cambridge. Dept. of Mathematics.
APPLICATION OF BEST LINEAR UNBIASED PREDICTION TO INTERPOLATION OF RANDOM FIELDS AND TO NETWORK DESIGN
Andre Cabannes Apr. 1980 34 p refs
(Contract N00014-75-C-0555)
(AD-A083656; TR-17) Avail: NTIS HC A03/MF A01 CSCL 12/2

The practical problem of monitoring air pollutant concentration over a geographical area, or of estimating the mining resources in a region or a field can both be formulated as a problem of interpolation of random field. Given a real-valued random field (Z(X),x an element of R to the m power) the basic problem is to interpolate Z over an area A from measurements taken at n stations x1 ,x2,...,xn, when the distribution of Z is only partially specified. The second problem is the choice of the network of stations. After deriving the form of the best linear unbiased predictor of Z we prove a general updating theorem which is useful both practically to quicken the computation of the new estimated map, and theoretically to study the problem of network design. Then we use this theorem to prove that when Z is a smooth random field (essentially differentiable in quadratic mean) the variance of estimation error of Z(x) is a discontinuous function of the arguments x1,x2,...,xn. We discuss the practical consequences of this result in the design of networks of stations. GRA

N80-28145# Texas Univ. at Austin. Center for Cybernetic Studies.
A PRIMAL SIMPLEX VARIANT FOR THE MAXIMUM FLOW PROBLEM
Fred Glover (Colorado Univ., Boulder), Darwin Klingman, John Mote (Analysis, Research, and Computation, Inc., Austin, Tex.), and David Whitman (Analysis Research, and Computation, Inc., Austin, Tex.) Dec. 1979 47 p refs
(Contracts N00014-78-C-0222; DOT-OST-70074)
(AD-A084282; CCS-362) Avail: NTIS HC A03/MF A01 CSCL 12/2

This paper presents a number of specialized implementations of the primal simplex algorithm for the maximum flow problem. Computational results indicate that some of these variants are both faster and require less computer storage than our best implementation of the classic labeling algorithm for maximum flow problems. GRA

N80-28146# Texas Univ. at Austin. Center for Cybernetic Studies.
SOLUTION APPROACHES FOR NETWORK FLOW PROBLEMS WITH MULTIPLE CRITERA
Darwin Klingman and John Mote (Systems Analyst, Analysis, Research and Computation, Inc.) Dec. 1979 41 p refs
(Contract N00014-78-C-0222)
(AD-A084283; CCS-363) Avail: NTIS HC A03/MF A01 CSCL 12/2

A network variant of the multicriteria linear programming problem is presented. The primal simplex multicriteria algorithm first developed by Yu and Zeleny is specialized to handle the simple basis structure of the multicriteria uncapacitated transshipment problem. Specifically, the basis tree representation and updating techniques that have proven to be successful for single criterion network flow problems are used to substantially reduce the computational effort required for the multicriteria simplex algorithm. The fundamental theoretical results for the general multicriteria linear programming problem are presented followed by a brief review of the relevant aspects of the network basis structure. Next, the specialized multicriteria primal simplex algorithm for the uncapacitated transshipment problem is presented and a small example problem is given. Then a network variant of the surrogate criterion linear programming approach is presented. For sake of illustration, the shortest path problem is used as the class of networks to be solved. However this approach can be easily extended to any of the other classes of network flow problems. In this section an interactive solution procedure is described that involves both the decision maker and the computer at each stage. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

No abstracts in this category.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-28147 State Univ. of New York at Buffalo.
MEASUREMENTS OF THE TEMPERATURE DEPENDENT DIAMAGNETISM OF LIQUIDS Ph.D. Thesis
Richard Keith Kunze 1979 179 p
Avail: Univ. Microfilms Order No. 8016207

Measurements of temperature dependence of the diamagnetism of various liquids performed using a high precision, (10 to the 10th power SI) superconducting magnetic susceptometer are reported and discussed. A microprocessor-based signal processing system was developed allowing the elimination of systematic error due to the background signal from the quartz sample holder and due to linear output drift. Partly to evaluate the temperature regulation of this prototype susceptometer, a measurement of the change in volume susceptibility at the well-studied gel to liquid crystal phase transition of dipalmitoylphosphatidylcholine vesicle dispersions was performed. The observed change is consistent with the known density change of the phospholipid bilayer and the assumption that the mass susceptibility of the system is constant through the transition. The measurements of methanol, acetic acid, deuterium oxide, chloroform, acetone, carbon tetrachloride, carbon disulfide, cyclohexane, and nitrobenzene indicate that hydrogen bonding is not a necessary condition for temperature dependent diamagnetism in liquids. Dissert. Abstr.

N80-28148# Pittsburgh Univ., Pa. Learning Research and Development Center.
REPRESENTATION OF PHYSICS KNOWLEDGE BY EXPERTS AND NOVICES
Michelene T. Chi, Paul J. Feltovich, and Robert Glaser 21 Mar. 1980 68 p refs
(Contract N00014-78-C-0375; NR Proj. 157-421)
(AD-A084452; TR-2) Avail: NTIS HC A04/MF A01 CSCL 12/2

The studies reported here investigate the representation and organization of physics knowledge in experts and novices. Four experiments investigate the existence of schemata for physics problems, qualitative and quantitative differences in schemata types used by experts and novices, differences in the content of these schemata, and features in the physics problems that activate problem representations. Results obtained from problem sorting tasks and protocol analysis reveal that novices and experts begin with specifiably different problem representations depending on the structure of their knowledge. The initial representation and subsequent approach to problem solution used by experts is based on physics principles abstracted from a problem, while novices base their representation and approaches on the problem's literal features. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-28149 Pennsylvania State Univ., University Park.
AN INVESTIGATION OF THE LOW-FREQUENCY SOUND FIELD OF A REVERBERANT ENCLOSURE AND THE EFFECTS OF DIGITAL ELECTRONIC FEEDBACK Ph.D. Thesis
John Baptist Ochs 1980 220 p
Avail: Univ. Microfilms Order No. 8015825

Low frequency fluctuation of the characteristics of the sound field was investigated in comparion to those characteristics at high frequency. Electronic feedback, using a single Finite Impulse Response (FIR) filter was implimented to beneficially change the degree of diffusion to increase the useful frequency range of reverberant enclosures for sound power measurements. This investigation included a computer model study and a experimental study in a model enclosure of the frequency-by-frequency fluctuation of the time-averaged spatial mean squared pressure as as it relates to sound power measurements; the normalized spatial variance, the probability density function and the cumulative distribution function of time-averaged squared pressure normalized to the spatially averaged cross correlation coefficient; and the vector intensity. The data from both the computer model and the experimental model showed that the feedback implemented did not significantly affect the diffusion of the sound field. Dissert. Abstr.

N80-28150*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TIME-OF-DAY CORRECTIONS TO AIRCRAFT NOISE METRICS
Sherman Clevenson, ed. and William T. Shepherd, ed. (FAA) Jun. 1980 81 p Workshop held in Hampton, Va., 11-12 Mar. 1980; sponsored by NASA and DOT
(NASA-CP-2135; FAA-EE-80-3; L-13779) Avail: NTIS HC A05/MF A01 CSCL 20A

The historical and background aspects of time-of-day corrections as well as the evidence supporting these corrections are discussed. Health, welfare, and economic impacts, needs a criteria, and government policy and regulation, are also reported. For individual titles, see N80-28151 through N80-28152.

N80-28151*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
HISTORICAL DEVELOPMENT OF NOISE EXPOSURE METRICS
William J. Galloway *In* NASA. Langley Res. Center Time-of-Day Corrections to Aircraft Noise Metrics Jun. 1980 p 7-18 (For primary document see N80-28150 18-71)
Avail: NTIS HC A05/MF A01 CSCL 20A

Some of the historical events that led to the introduction of night penalties are reported with emphasis on what happens with different kinds of day/night operations when night pentalties are employed. These effects are considered in terms of the difference between a nighttime weighting cumulative measure of noise exposure verses simply not using any night weighting at all, in decibles. R.C.T.

N80-28152*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RESEARCH PERSPECTIVE: TIME-OF-DAY EFFECTS ON NOISE ANNOYANCE
James M. Fields *In its* Time-of-Day Corrections to Aircraft Noise Metrics Jun. 1980 p 19-30 (For primary document see N80-28150 18-71)
Avail: NTIS HC A05/MF A01 CSCL 20A

Some of the complications encountered in researching time-of-day effects on noise annoyance are reported. A conceptual framework for further research is provided. Some of the implications for the research methods that should be used are suggested. R.C.T.

N80-28153# Watkins and Associates, Lexington, Ky.
ASSESSMENT OF THE ENVIRONMENTAL COMPATIBILITY OF DIFFERING HELICOPTER NOISE CERTIFICATION STANDARDS Final Report
Richard G. Edwards, Alvin B. Broderson, Roger W. Barbour, Donald F. McCoy, and Charles W. Johnson Jun. 1979 67 p refs Prepared in cooperation with Kentucky Univ., Lexington
(Contract DOT-FA78WA-4194)
(AD-A080525; FAA-AEE-79-13) Avail: NTIS HC A04/MF A01 CSCL 01/2

Areas having the heaviest helicopter activity in the U.S. were visited and environmental noise measurement made in order to evaluate the impact of possible relaxed noise emission standards

for helicopters restricted to remote regions. Measurement results showed that an average of 10 flyovers per hour produced a one hour energy-averaged sound level (Leq) of 54.5 dBA, a level 2.5 dBA above ambient. An average of 34 events per hour adjacent to heliports produced a one-hour Leq of 63.1 dBA, which was 13.3 dBa above ambient. If emission levels were increased by 10 dBA, projected Leq values of 57.0 and 71.2 dBA resulted for the flyover and heliport conditions, respectively. Sixty-four percent of those responding to a questionnaire stated that they had not experienced a problem from helicopter noise. The degree to which the remaining respondents were bothered ranged from (slightly) to (very annoyed) with no significant preference for either category. GRA

N80-28154# Naval Surface Weapons Center, White Oak, Md.
SURFACE WAVES AND ANOMALOUS SOUND ABSORPTION Final Report
Ronald L. Kligman 1 Jan. 1980 51 p refs
(SF43452702)
(AD-A083844; NSWC-TR-79-481) Avail: NTIS HC A04/MF A01 CSCL 20/1

A theoretical model of surface waves in equilibrium with acoustic waves at a fluid-fluid interface is developed. Modifications to the usual pressure and particle velocity boundary conditions lead to a dispersion relation for the waves of the coupled system. An expression for the total reflection coefficient is found. The ratio of acoustic energy absorbed due to reflection from the interface to the incident wave energy is calculated making use of the previously obtained reflection coefficient. GRA

N80-28155# Army Construction Engineering Research Lab., Champaign, Ill. Environmental Div.
TRUE-INTEGRATING ENVIRONMENTAL NOISE MONITOR AND SOUND-EXPOSURE LEVEL METER. VOLUME 4: MECHANICAL CONSTRUCTION AND ELECTRICAL CHECK OUT Final Report
A. J. Averbuch and R. Brown Mar. 1980 47 p refs
(DA Proj. 4A7-62720-A-896)
(AD-A083321; CERL-TR-N-41-Vol-4) Avail: NTIS HC A03/MF A01 CSCL 20/1

This volume gives the assembly, adjustment, and checkout procedures necessary to construct a U.S. Army Construction Engineering Research Laboratory (CERL) True-Integrating Environmental Noise Monitor and Sound-Exposure Level Meter. It describes the monitor's mechanical layout, wiring guidelines, adjustments to components to bring various circuits into tolerance, and steps for verifying the correct operation of the monitor. Also included are test programs to be executed by the internal microprocessor to exercise the internal circuit to help checkout or repair. GRA

N80-28156# Army Construction Engineering Research Lab., Champaign, Ill.
TRUE-INTEGRATING ENVIRONMENTAL NOISE MONITOR AND SOUND-EXPOSURE LEVEL METER. VOLUME 3: MICROPROCESSOR PROGRAM AND DATA INTERFACE DESCRIPTION Final Report
A. J. Averbuch and L. M. Little Mar. 1980 175 p
(DA Proj. 4A7-62720-A-896)
(AD-A083320; CERL-TR-N-41-Vol-3) Avail: NTIS HC A08/MF A01 CSCL 20/1

This report describes the internal microprocessor program used to operate the U.S. Army Construction Engineering Research Laboratory (CERL) True-Integrating Environmental Noise Monitor and Sound-Exposure Level Meter. Several data interface accessories are also described; complete program listings are included. GRA

N80-28157# Wyle Labs., Inc., El Segundo, Calif.
CORRECTION PROCEDURES FOR AIRCRAFT NOISE DATA. VOLUME 1: PSEUDOTONES Final Report
R. Rackl Dec. 1979 210 p refs
(Contract DOT-FA78WA-4143)
(AD-A081962; WR-79-9-Vol-1; FAA/EE-80-1-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 20/1

Pseudotones are spectral irregularities due to ground reflections which can cause tone corrections in the calculation of Effective Perceived Noise Level which are not generated by the aircraft itself. Several analytical (reflection theory, lower cutoff frequency for tone corrections) and instrumentation (ground and pole microphones) methods were investigated which remove the pseudotones. In support of this study, a substantial number of aircraft noise measurements were obtained and analyzed in detail; these data are also summarized in the report. GRA

N80-28158# Wyle Labs., Inc., El Segundo, Calif.
CORRECTION PROCEDURES FOR AIRCRAFT NOISE DATA. VOLUME 2: BACKGROUND NOISE CONSIDERATIONS Final Report
L. Sutherland, J. Parkinson, and D. Hoy Dec. 1979 115 p
(Contract DOT-FA78WA-4143)
(AD-A082011; WR-79-9-Vol-2; FAA-EE-80-1-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 20/1

The impact of background noise on the value of PNL, PNLT, and the resulting EPNL noise metric in aircraft certification to FAR Part 36 is examined in this report, the second in a series of reports on aircraft noise measurement correction procedures. Procedures to remove background noise effects from data measured in the form of one-third octave band sound pressure levels for jet and large propeller aircraft, or data in the form of A-weighted noise levels for light propeller driven aircraft, are defined. After evaluating various techniques for different ratios of signal-to-background noise, one simple correction method for turbojet/turbofan aircraft noise is proposed. The recommended method consists of applying an energy correction, up to a maximum of -10 dB, for that portion of the background noise spectra dominated by energy-adding or predetection background noise. For the remaining portion of the background noise spectra, the non-additive postdetection background noise floor tends to mask out bands very close to or below this noise floor. A simple spectrum extrapolation procedure is recommended in this case. Another background noise correction method for light propeller aircraft noise is also proposed. This procedure simply involves application of an energy correction to the 'as measured' A-weighted aircraft signal using the A-weighted background noise level. Procedures are also suggested for measuring the background noise level in order to account for the randomness of the fluctuating background noise level. GRA

N80-28159# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
THE EFFECTS OF HIGH LEVEL INFRASOUND
Daniel L. Johnson Feb. 1980 16 p refs presented at Conf. on Low Freq. Noise and Hearing, Aalborg, Denmark, 7-9 May 1980 Submitted for publication
(AF Proj. 7321; AF Proj. 7184)
(AD-A081792; AMRL-TR-80-13) Avail: NTIS HC A02/MF A01 CSCL 06/19

This paper will attempt to survey the current knowledge on the effects of relative high levels of infrasound on humans. While this conference is concerned mainly about hearing, some discussion of other physiological effects is appropriate. Such discussion also serves to highlight a basic question, 'Is hearing the main concern of infrasound and low frequency exposure, or is there a more sensitive mechanism'. It would be comforting to know that the focal point of this conference is indeed the most important concern. Therefore, besides hearing loss and auditory threshold of infrasonic and low frequency exposure, four other effects will be provided. These are performance, respiration, annoyance, and vibration. GRA

N80-28160# Utah Univ., Salt Lake City. Dept. of Mathematics.
TRANSIENT ACOUSTIC WAVE PROPAGATION IN AN EPSTEIN DUCT Summary Report
Calvin H. Wilcox Nov. 1979 50 p refs
(Contract N00014-76-C-0276)
(AD-A083484; TR-36) Avail: NTIS HC A03/MF A01 CSCL 20/1

Transient acoustic wave propagation is analyzed for the case of an unlimited plane-stratified fluid having constant density and sound speed c (y) at depth y given by the Epstein profile 1/c squared (y) + K sech squared (y/H) + L tanh (y/H) + M. The acoustic potential is a solution of the wave equation Dt squared u-c squared (y) (D1 squared u + D2 squared u + Dy squared u) = f(t,x,y) where x = (x sub 1, x sub 2) are horizontal coordinates

and f(t,x,y) characterizes the wave sources. The principle results show that u is the sum of a free component, which behaves like a diverging spherical wave for large t, and a guided component which is approximately localized in a region abs. val. (y-y sub o) < or = h and propagates outward in horizontal planes like a diverging cylindrical wave. M.G.

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-28161 California Univ., Los Angeles.
STUDIES IN INTRAMOLECULAR MOTION Ph.D. Thesis
Paul Richard Stannard 1980 137 p
Avail: Univ. Microfilms Order No. 8016046

Five self contained articles written for scientific journals that all deal with the dynamical behavior of an isolated molecule in an excited energy state are presented. The first differs from the rest however, and examines the effect of coupling between vibrational levels belonging to different Born-Oppenheimer electronic states. The remaining four articles are all concerned with the Local Mode Model of molecular vibrations (in only one electronic state). Both the Local Mode (LM) and the better known Normal Mode (NM) model seek to separate the complicated many dimensional vibrational motion of a polyatomic molecule into a superposition of one dimensional oscillations. The question of which is the best zeroth-order description is examined and qualitative and quantitative criteria are introduced. A calculation to compare the effectiveness of NM and LM approximations in describing the fundamental absorptions in water is described along with the question of molecular symmetry in a LM picture. The effect of breakdown of separability on intramolecular dynamics, in glyoxal, water and benzene is explained.
Dissert. Abstr.

N80-28162 Pittsburgh Univ., Pa.
STUDIES IN THE IONIZATION OF ATOMS AND IONS BY PHOTONS Ph.D. Thesis
David John Botto 1979 206 p
Avail: Univ. Microfilms Order No. 8015291

Three aspects of the ionization of atoms and ions by photons are discussed. (1) Analytic expression previously derived for neutral atoms are employed to describe inner shell nonrelativistic dipole photoeffect cross sections for positively charged atomic ions. The simple dependence of these cross sections on nuclear charge Z and ionic charge Z results from scaling. (2) A numerical calculation of the radiative corrections to the atomic photoeffect is performed for the K shell of a hydrogenlike atom to lowest order in radiation field assuming the polarization of the electron and photon are not observed. Dependence of these corrections on the photon energy and the detector's energy resolution are discussed. (3) A survey of the present status of the theory and experiment for Compton scattering is given. The validity of the various theoretical approaches is discussed. A formalism for the calculation of Compton scattering cross sections in a relativistic partial wave expansion in a central potential is developed. Dissert. Abstr.

N80-28163 California Univ., Berkeley.
MULTIPHOTON DISSOCIATION OF POLYATOMIC MOLECULES Ph.D. Thesis
Peter Anfaenger Schulz 1979 138 p
Avail: Univ. Microfilms Order No. 8014823

The dynamics of infrared multiphoton excitation and dissociation of SF6 was investigated under collision free conditions by a crossed laser-molecular beam method. In order to understand the excitation mechanism and to elucidate the requirements of laser intensity and energy fluence, a series of experiments were carried out to measure the dissociation yield dependences on energy fluence, vibrational temperature of SF6, the pulse duration of the CO2 laser and the frequency in both one and two laser experiments. Translational energy distributions of the SF5 dissociation product measured by time of flight and angular distributions and the dissociation lifetime of excited SF6 as inferred from the observation of secondary-dissociation of SF5 into SF4 and F during the laser pulse suggest that the dynamics of dissociation of excited molecules is dominated by complete energy randomization and rapid intramolecular energy transfer on a nanosecond timescale, and can be adequately described by RRKM theory. Dissert. Abstr.

N80-28164 California Univ., Berkeley.
MULTIPHOTON PROCESSES IN ISOLATED ATOMS AND MOLECULES Ph.D. Thesis
Assmund Sveinung Sudbo 1979 160 p
Avail: Univ. Microfilms Order No. 8014899

The theory of coherent excitation of a multilevel quantum mechanical system is developed. Damping of the system is taken into account by the use of a density matrix formalism. General properties of the wave function and/or the density matrix are discussed. The physical implications for the behavior of the system are described, together with possible applications of the formalism, including the infrared multiphoton excitation of molecules, and optical pumping in alkali atoms. Experimental results on the infrared multiphoton dissociation of molecules are presented followed by a discussion of the general features of this process. The experimental results were obtained using a crossed laser and molecular beam method, and the emphasis is on determining the properties of the dissociating molecule and the dissociation products. The dissociation process is shown to be described very well by the standard statistical theory (RRKM theory) of unimolecular reactions, a brief presentation of which is also included. Dissert. Abstr.

N80-28165 California Univ., Berkeley.
LASER INDUCED FLUORESCENCE OF TRAPPED MOLECULAR IONS Ph.D. Thesis
Frederick Joseph Grieman 1979 251 p
Avail: Univ. Microfilms Order No. 8014713

An experimental apparatus for obtaining the optical spectra of molecular ions is described. The experimental technique includes the use of three dimensional ion trapping, laser induced fluorescence, and gated photon counting methods. In the laser induced fluorescence technique employed in this experiment the ions, after being stored and mass selected, are interrogated by an intense, narrow bandwidth dye laser pulse ten nanoseconds in duration. Any subsequent fluorescence is not dispersed but is detected by a bare photomultiplier tube. The signals is further enhanced by signal averaging which is accomplished using an on-line minicomputer. The computer also controls the progress of the experiment and normalizes the fluorescence signal with respect to laser power and ion density which are monitored throughout the experiment. The result is a fluorescence excitation spectrum which in many instances contains the same information as an absorption spectrum. The spectra of the molecular ions studied by this experimental technique are presented.
Dissert. Abstr.

N80-28166 California Univ., Berkeley.
CROSSED BEAM STUDIES OF FULL AND HALF COLLISIONS Ph.D. Thesis
Randal Kenneth Sparks 1979 171 p
Avail: Univ. Microfilms Order No. 8014889

The results of two experiments performed on very high resolution crossed molecular beams apparatus are discussed. The first experiment, photofragmentation of methyl iodide, is deconvoluted to yield vibrational state distributions for the recoiling methyl fragment. These distributions are then analyzed in terms of half-collision models and Franck-Condon factors. The second experiment, a full-collision example, is the reaction of F atoms with H2 and D2. Laboratory angular and velocity distributions for both systems are obtained at several energies. Center-of-mass product distributions are calculated and discussed in terms of recently predicted state dependent resonance phenomena for the reaction. The design of the apparatus is also discussed.
Dissert. Abstr.

N80-28167*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TABLES OF TRANSITION PROBABILITIES AND BRANCHING RATIOS FOR ELECTRIC DIPOLE TRANSMISSIONS BETWEEN ARBITRARY LEVELS OF HYDROGEN-LIKE ATOMS

Kazem Omidvar Jun. 1980 35 p refs
(NASA-TM-80682) Avail: NTIS HC A03/MF A01 CSCL 20H

Branching ratios in hydrogen-like atoms due to electric-dipole transitions are tabulated for the initial principal and angular momentum quantum number n, lambda, and final principal and angular momentum quantum numbers n, lambda. In table 1, transition probabilities are given for transitions n, lambda, yields n, where sums have been made with respect to lambda. In this table, $2 < or = n' < or = 10$, $0 < or = lambda' < or = n'-1$, and $1 < or = n < or = n'-1$. In addition, averages with respect to lambda' and sums with respect to n, and lifetimes are given. In table 2, branching ratios are given for transitions n' lambda' yields ni, where sums have been made with respect to lambda. In these tables, $2 < or = n' < or = 10$, $0 < or = lambda', < n'-1$, and $1 < or = n < or = n'-1$. Averages with respect to lambda' are also given. In table 3, branching ratios are given for transitions n' lambda' yields in lambda, where $1 < or = n < or = 5$, $0 < or = lambda < or = n-1$, $n < n' < or = 15$, and $0 < or = lambda' < or = n(s)$, where n(s), is the smaller of the two numbers n'-1 and 6. Averages with respect to lambda' are given. Author

N80-28168# Hawaii Univ., Honolulu. Dept. of Physics and Astronomy.
LOW ENERGY X-RAY AND ELECTRON INTERACTIONS WITHIN MATTER Interim Scientific Report, 1 Oct. 1978 - 30 Sep. 1979
Burton L. Henke Mar. 1980 65 p refs
(Grant AF-AFOSR-0027-79; AF Proj. 2301)
(AD-A083962; AFOSR-80-0294TR) Avail: NTIS HC A04/MF A01 CSCL 20/8

This research program is concerned with the physics and the application of low energy X-ray and associated electron interactions. It has been concentrated upon the sub-kilovolt energy region where the need has been greatest for the development of efficient and precise spectroscopic methods, for the measurement of fundamental interaction cross sections, and for the basic theoretical modeling of certain important X-ray and electron interaction processes as, for example, X-ray induced photoemission and fluorescence. This work is applied to two areas of considerable present importance and need: the development of high efficiency spectroscopic methods that can be effectively applied to the diagnostics of high temperature plasmas - particularly as generated by high power pulsed lasers, electron or ion beams and by exploding wires, for which high temporal resolution as well as high spectral resolution is needed; and the testing and application of high-efficiency low-energy fluorescent spectroscopic measurement and analysis for valence and molecular orbital electron energy state studies, for the solid state characterization of surfaces, and for studies of the effects of radiation damage. GRA

N80-28169# Washington Univ., Seattle. Dept. of Chemistry.
GAS SURFACE VIBRATIONAL ENERGY TRANSFER IN THE TRANSIENT REGION OF A LOW PRESSURE UNIMOLECULAR REACTION
B. D. Barton, D. F. Kelley, and B. S. Rabinovitch 31 Mar. 1980 24 p refs
(Contract N00014-75-C-0690)
(AD-A083944; TR-15) Avail: NTIS HC A02/MF A01 CSCL 07/4

The Variable Encounter Method was applied to the study of the transient region in vibrational accommodation of reacting cyclopropane at surfaces. Collision efficiency declines with rise of temperature. Surface collisions are more efficient than binary gas phase encounters but declines with rise of temperature. The results agree with an independent earlier study we have made on cyclopropane-d2. GRA

N80-28170# Rockwell International Science Center, Thousand Oaks, Calif.
GROWTH OF HgCdTe BY MODIFIED MOLECULAR BEAM EPITAXY (MBE) Semiannual Technical Report, 1 Sep. 1979 - 29 Feb. 1980
J. T. Cheung Mar. 1980 33 p refs
(Contract MDA903-79-C-0188; DARPA Order 3704)
(AD-A083799; SC5202.6SA) Avail: NTIS HC A03/MF A01 CSCL 07/4

An investigation was made on the deposition of HgCdTe thin film on CdTe by irradiating the bulk source material with high power laser pulses. The morphological features and stoichiometric composition depend very strongly on the laser characteristics and the scanning rate. Under very high power operation, the dominant deposition process is the condensation of micron size molten globules 'blown-off' from the source material. At lower power level, the film formation is largely due to the deposition of small molecular clusters. Compositional analysis of the film showed that the CdTe end of the alloy evaporated congruently, whereas the HgTe end suffered some loss of Hg. The amount of Hg loss could be reduced by varying the laser power and the scanning rate. N-type films up to 2 microns thick were deposited in this manner and photoconductive devices were fabricated and measured. We have also made a detailed mass spectrometric study of the evaporant composition under different conditions. A model on the evaporation mechanism formulated from such information will be discussed. GRA

N80-28171# JAYCOR, Alexandria, Va.
AXIAL AND RADIAL COMPRESSION OF ION BEAMS Final Report, 15 Jan. 1979 - 28 Feb. 1980
Shyke A. Goldstein and Paul F. Ottinger Mar. 1980 109 p refs
(Contract N00173-79-C-0420)
(AD-A083702; JAYCOR-TPD200-80-003-FR) Avail: NTIS HC A06/MF A01 CSCL 20/8

The present report concentrates on the physics of propagating intense ion beams in plasma channels. In particular, the theoretical aspects are studied of the possible effects during ion beam transport on the structure of electromagnetic fields in the plasma. The ion orbits were solved for different classes of plasma channels including bumpy ones in order to evaluate the sensitivity of beam losses due to channels that deviate from idealistic shapes. The consideration of different plasma instabilities, the hydrodynamic motion of the plasma, propagation in filamentary channels and beam energy losses put realistic limits on how much ion current can be propagated using the simple steady plasma channel concept. Axial bunching of the beam (via time dependent voltage ramping of the ion diode) was analyzed and found to be a sound concept as long as no more than an order of magnitude pulse compression is attempted. The radial compression is viable on a small scale in tapered channels (giving a factor of 2 increase in current density) and on a large scale if self magnetic fields fully penetrate the media (giving rise to an order of magnitude increase in ion beam current density). Further theoretical investigation on the details of the above mechanisms are presently in progress including new plasma channel schemes that help to push upwards the limits on the ion currents. GRA

N80-28172# SRI International Corp., Menlo Park, Calif. Molecular Physics Lab.
INELASTIC COLLISIONS OF EXCITED ATOMS Final Report, Oct. 1976 - Mar. 1980
Michael J. Coggiola 29 Apr. 1980 108 p refs
(Contract N00014-76-C-0118)
(AD-A084524; SRI-MP-80-50) Avail: NTIS HC A06/MF A01 CSCL 07/4

The interaction of metastable rare gas atoms with ground state atoms is being investigated in the energy range from several eV to several keV. Emphasis is on collisional ionization and collisional excitation transfer. Additional work examines the details of the charge transfer reaction used to produce the fast metastable beams. GRA

N80-28173# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
PHOTOCHEMICAL CONSEQUENCES OF INTERCHROMOPHORIC INTERACTIONS Final Report, 15 Oct. 1975 - 1 Feb. 1980
Harry Morrison 5 May 1980 4 p
(Grants DAAG29-79-G-0009; DAAG29-76-G-0066)
(AD-A084712; ARO-13088.9-C; ARO-16012.4-C) Avail: NTIS HC A02/MF A01 CSCL 07/4

This constitutes the final technical report on a project which has dealt with the photochemical and photophysical consequences

of interaction between two or more nonconjugated functional groups in an organic molecule. GRA

N80-28174# California Univ., Berkeley. Dept. of Chemistry.
CROSSED MOLECULAR BEAM STUDY OF THE REACTIONS OF OXYGEN AND FLUORINE ATOMS Annual Report, Jan. 1979 - Feb. 1980
Yuan T. Lee 1 Mar. 1980 36 p refs
(Contract N00014-75-C-0671)
(AD-A084255; UC-75-C-0671-80) Avail: NTIS HC A03/MF A01 CSCL 07/4

Rapid developments in the study of oxygen reaction chemistry occurred as it is succeeded in obtaining an O(1D) beam source and commenced investigating the dynamics of several important reactions of O(3P) and O(1D). In the reaction of O(3P) with C6H6 and C6D6, two competing channels, one producing a stabilized addition complex and the other forming radical products C6H5O - H has been identified. Studies of the effects of collision energy and of deuteration were used to clarify the reaction mechanism. The reaction of O(3P) with another aromatic hydrocarbon toluene, results in competition between two substitution channels, loss of H atom and loss of CH3. In contrast to the O - C6H6 reaction, no stabilized oxygen-toluene adduct was observe. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-28175# Battelle Pacific Northwest Labs., Richland, Wash.
ASSESSMENT OF EFFECTIVENESS OF GEOLOGIC ISOLATION SYSTEMS. TEST CASE RELEASE CONSEQUENCE ANALYSIS FOR A SPENT FUEL REPOSITORY IN BEDDED SALT
J. R. Raymond, F. W. Bond, C. R. Cole, R. W. Nelson, A. E. Reisenauer, J. F. Washburn, N. A. Norman (Bechtel National, Inc.), P. A. Mote (Bechtel National, Inc.), and G. Segol (Bechtel National, Inc.) Jan. 1980 82 p refs
(Contract EY-76-C-06-1830)
(PNL-2782) Avail: NTIS HC A05/MF A01

Geological and geohydrologic data for the Paradox Basin were used to simulate movement of ground water and radioactive contaminants from a hypothetic nuclear reactor spent fuel repository after an assumed accidental release. The pathlines, travel times and velocity of the ground water from the repository to the discharge locale (river) were determined after the disruptive event by use of a two dimensional finite difference hydrologic model. The concentration of radioactive contaminants in the ground water was calculated along a series of flow tubes by use of a one dimensional mass transport model which takes into account convection, dispersion, contaminant/media interactions and radioactive decay. For the hypothetical site location and specific parameters used in this demonstration, it is found that Iodine-129 is the only isotope reaching the Colorado River in significant concentration. This concentration occurs about 8.0 x 10 to the 5th power years after the repository has been breached. DOE

74 OPTICS

Includes light phenomena.

N80-28176 Rochester Univ., N. Y.
MEASUREMENT OF STRONGLY REFRACTING, THREE-DIMENSIONAL INDEX DISTRIBUTIONS Ph.D. Thesis
Glen Walden Johnson 1980 167 p
Avail: Univ. Microfilms Order No. 8014330

Procedures for specifying a general class of optical systems were developed and incorporated into a computer program. Provisions are included for tracing rays through regions having inhomogeneous refractive indices. For this purpose, a vector form of the Runge-Kutta-Nystrom integration technique was applied. The first of two examples discusses the design of a series of lenses from a glass whose refractive index is described by an axial, Gaussian distribution. The second example explores several potential sources of error in the measurement of gradient index fibers where the direction of the probing light is perpendicular to the fiber's optical axis. A homodyne, modified Mach-Zehnder interferometer was built to measure gradient index samples by probing the sample over a range of angles about the gradient direction. Two types of measurements of a gradient index lens blank, having a Gaussian index distribution, are presented. First, a wavefront map of the blank reveals imperfections in the gradient. Second, a series of measurements are made that are analyzed by simulating the test conditions. Dissert. Abstr.

N80-28177 Cornell Univ., Ithaca, N. Y.
OPTICAL PROPERTIES AND SOLAR SELECTIVITY OF METAL-INSULATOR COMPOSITE FILMS Ph.D. Thesis
Harold Gene Craighead 1980 192 p
Avail: Univ. Microfilms Order No. 8015657

The results of an experimental study of metal-insulator composite films are described. A description of the entire process of sample production, characterization, experimental examination and ultimate demonstration of an application is included. The problem considered was to measure the optical constants of metal insulator-composite materials and check the applicability of effective medium-composite materials and check the applicability of effective medium theories in predicting their optical properties. With this knowledge, there was also the goal of designing and fabricating efficient and durable solar photothermal absorber surfaces. The method used for controlled coevaporation of microscopically segregated metal-insulator composites is described. With this technique many different composites were produced; the most notable ones were Ni/Al2O3, Au/Al2O3, Au/MgO, Ag/MgO and Pt/Al2O3. Dissert. Abstr.

N80-28178 California Inst. of Tech., Pasadena.
PHASE CONJUGATE OPTICS: ON THE THEORY, OBSERVATION, AND UTILIZATION OF TEMPORALLY-REVERSED WAVEFRONTS AS GENERATED VIA NONLINEAR OPTICAL PARAMETRIC INTERACTIONS Ph.D. Thesis
David Mort Pepper 1980 330 p
Avail: Univ. Microfilms Order No. 8014305

Theoretical and experimental aspects as well as potential applications in the field of coherent optics known as Phase Conjugate Optics (PCO). The ability of PCO to correct for image modal dispersion in optical waveguides as well as the use of PCO to perform real time coherent image processing and nonlinear microscopy is discussed. Temporal-frequency domain applications of PCO analyzed include the use of a nearly degenerate four-wave mixing process as a narrowband, wide field-of-view optical filter, capable of an amplified bandpass. The ability of a PCO interaction to renarrow (transform limited) optical pulses which have been temporally spread due to propagation through (group velocity) dispersive channels is analyzed. A potential application of PCO in the field of nonlinear laser spectroscopy is presented. Specifically, the scattering of a probe photon off a two-photon coherent state (created in a three-level atomic system) is shown to yield a conjugate replica. Dissert. Abstr.

N80-28179# Oregon Graduate Center for Study and Research, Beaverton.
WAVE PROPAGATION IN PARTICULATE MEDIA Annual Summary Report, 1 Sep. 1979 - 15 Apr. 1980
Richard A. Elliott 18 Apr. 1980 11 p
(Contract N00014-79-C-0897)
(AD-A083742) Avail: NTIS HC A02/MF A01 CSCL 20/6

Progress in developing techniques for producing well characterized scattering media from dielectric liquid emulsions and the design of equipment to measure their optical properties and their effect on laser pulse propagation are outlined. GRA

N80-28180# Brown Univ., Providence, R. I. Div. of Engineering
REMOTE OPTICAL CONTROL AND SWITCHING IN OPTICAL FIBER LINKS Final Technical Report, 1 Oct.

1977 - 30 Sep. 1978
R. V. Gauthier and A. V. Nurmikko Griffiss AFB, N.Y. RADC Jan. 1980 46 p refs
(Contract F19628-78-C-0009; AF Proj. 0176)
(AD-A083659; RADC-TR-79-346) Avail: NTIS HC A03/MF A01 CSCL 20/6

In this project work, means were considered to achieve high-speed (GHz) switching and modulation in integrated optical circuits, suitable for fiber optics applications. In particular, design and performance criteria were calculated for a planar coupled optical channel device, electro-optically switched by synchronous electrical signals propagating along an asymmetric coplanar waveguide stripline. Design was also executed for several of the components in the laboratory although full integration was not completed within the project period. GRA

N80-28181# Fairleigh Dickinson Univ., Teaneck, N.J. Dept. of Physics.
DETERMINATION OF THE OPTICAL CONSTANTS OF HIGHLY ABSORBING MATERIALS IN THE INFRARED REGION Final Report, 1 May 1978 - 30 Jun. 1979
K. D. Moeller and V. P. Tomaselli Aberdeen Proving Ground, Md. Army Armament Research and Development Command Feb. 1980 37 p
(Contract DAAK10-77-C-0121)
(AD-A083883; AD-E410244; FDU-2; ARCSL-CR-80024) Avail: NTIS HC A03/MF A01 CSCL 20/6

The behavior of electromagnetic waves in ideal lossless dielectrics is used to generate expressions for the reflection coefficients. Strongly absorbing dielectrics are considered and methods for evaluating their optical constants are presented. The effect of polarized infrared radiation on measured reflected intensities is detailed. Anisotropic materials and their particular measurement problems are discussed. Application to powder spectroscopy of highly absorbing materials is made. A summary of experimental results is presented. GRA

N80-28182# ITT Electro-Optical Products Div., Roanoke, Va.
MANUFACTURING METHODS AND TECHNOLOGY PROGRAM FOR RUGGEDIZED TACTICAL FIBER OPTIC CABLE Quarterly Progress Report, 1 Jul. - 30 Sep. 1979
R. Hoss and L. Ptaschek 26 Oct. 1979 86 p refs
(Contract DAAK80-79-C-0789)
(AD-A084191; CORADCOM-79-0789-1; QPR-1) Avail: NTIS HC A05/MF A01 CSCL 20/6

This report covers the first quarter of the Manufacturing Methods and Technology Program for Ruggedized Tactical Fiber Optic Cable. The scope of this quarter's effort, as reported herein, includes the following tasks and achievements: (1) cable process optimization: selection and ordering of polyurethanes for cable jackets, and fabrication and optical testing of the first engineering sample; (2) facilitization: high speed strander setup and operation, extruder setup, and fiber optic measurement station design; and (3) secondary performance milestones: 1st sample cable induced attenuation measurements. In addition to reporting progress on these milestones the report covers any revisions or improvements in process, equipment, tooling manufacturing flow and specifications. Key personnel on the program are identified. The program milestones for the next quarter are listed. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *45 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-28183 State Univ. of New York at Buffalo.
MHD CHANNEL FLOW AND HEAT TRANSFER IN A TIME-DEPENDENT SPATIALLY VARYING MAGNETIC FIELD Ph.D. Thesis
Subramani Rajaram 1980 282 p
Avail: Univ. Microfilms Order No. 8016238

The problem of fluid flow and heat transfer in the entrance region of a parallel plate channel under the influence of a magnetic field was studied. The magnetic field is not restricted to be steady and uniform but could be nonuniform or time-dependent and arbitrarily inclined to the channel axis. In addition, the wall conductivity is arbitrary. The problem is formulated in a way for the magnetic induction equation so that it is similar to the vorticity transport equation. Boundary layer simplications were not made and the complete Navier-Stokes equations were considered. The formulation of the problem enables all of the equations to be written in a single form. The heat transfer problem was classified into the constant wall temperature and constant wall heat flux problems. The complete energy equation with volumetric heat generation is considered. The problem has been solved for the case where velocity is already fully developed as temperature starts developing and for the simultaneous development of velocity and temperature. The effect of increasing the magnetic field is to enhance heat transfer. The problem is studied for a uniform and inclined field. The effect of increasing the inclination of the field is also to increase heat transfer at the walls due to a flattening of the velocity profiles. This effect is predominant for higher Peclet and Prandtl numbers. Dissert. Abstr.

N80-28184 California Univ., Los Angeles.
EXPERIMENTAL INVESTIGATION OF THE ANOMALOUS SKIN EFFECT AND COMPUTER SIMULATION OF THE COLLISIONLESS INTERCHANGE INSTABILITY Ph.D. Thesis
Heinz Goede 1980 188 p
Avail: Univ. Microfilms Order No. 8015979

The penetration of low frequency (omega $<<$ omega sub pe) electromagnetic waves into a uniform, collisionless, gaseous plasma is experimentally investigated. Measurements of the radial spatial decay of the oscillating magnetic field are used to obtain values of the skin depth. For fixed plasma density and temperature, field penetration is observed to remain constant until the frequency of the electromagnetic wave is low enough for electron thermal effects to become important. The enhanced penetration that occurs at this point is attributed to the well known anomalous skin effect that has been measured in solid state plasmas. In addition, a computer simulation study of the interchange instability in a two-dimensional, collisionless, zero-beta plasma is presented. Of particular interest is to examine whether compressional effects of a plasma immersed in an inhomogeneous magnetic field can lead to the stabilization of the interchange mode for parallel plasma pressure and magnetic field gradients as predicted by ideal magnetohydrodynamic theory. The simulation results indicate that, while stable states with plasma density and magnetic field gradients in the same direction exist, the fluid stability condition is not an optimistic one. Dissert. Abstr.

N80-28185 Cornell Univ., Ithaca, N. Y.
THE EQUILIBRIUM AND COMPRESSION OF ION RINGS Ph.D. Thesis
David Allan Larrabee 1980 251 p
Avail: Univ. Microfilms Order No. 8015698

The equilibrium properties of ion rings and their behavior during compression is discussed. The equations describing nonrelativistic ion rings are discussed in general terms. A commonly used model for ring equilibria, the exponential rigid rotor, is examined in detail numerically. It is concluded that this model does not adequately describe the expected equilibrium in reactor-type systems where the aspect ratio of the rings is small, (e.e., the ring is fat) due to the presence of untrapped particles. This is shown numerically by comparing this model with a model of the same form but without the untrapped particles.
Dissert. Abstr.

N80-28186 California Univ., Berkeley.
INSTABILITIES OF A MAGNETIZED PLASMA DRIVEN BY A VELOCITY RING OR A DENSITY GRADIENT Ph.D. Thesis
Jae Koo Lee 1979 149 p
Avail: Univ. Microfilms Order No. 8014774

The interaction of magnetized monoenergetic ions (a ring in velocity space) with a homogeneous Maxwellian target plasma is studied. Numerical studies using linear Vlasov theory and the results of computer simulations are presented. The velocity-ring-driven instability is classified into three distinct regimes based on the beam density relative to the plasma density relative to the plasma density, where physical mechanisms, dispersion diagrams and maximum growth rates are quite different, adding

to previously known results. The ring-plasma instability is studied through electrostatic and electromagnetic simulations, treating the ring ions as particles and the target plasma (ions and electrons) as linearized fluids. Simulation results follow very closely the predictions of the linear Vlasov theory and provide extensive information on nonlinear features such as beam spreading, slowing down, and saturation, some of which are in agreement with analytic explanations. Dissert. Abstr.

N80-28187 California Univ., Berkeley.
A STUDY OF THE GENERAL PLASMA CHARACTERISTICS OF A HIGH POWER, MULTIFILAMENT ION SOURCE Ph.D. Thesis
Kurt Francis Schoenberg 1979 137 p
Avail: Univ. Microfilms Order No. 8014871

Results of steady state measurements, obtained via a pulsed electrostatic probe data acquisition system, and fluctuation measurements, obtained via a broadband digital spectral analysis system, are presented. It is concluded that: (1) source electron distribution function consists of a bulk component of thermalized electrons comprising 90% to 97% of the total electron population, plus a nonthermal high energy tail which is a monotonically significant electron population at energy values 10 to 15 eV above maximum cathode fall; (2) source plasma fluctuations are caused by ion acoustic waves, initially excited by a current driven instability at the thermionic cathode; and (3) fluctuation spectral energy density is highly nonthermal and exhibits a resonant profile set by the periodic multifilament structure in the source plasma chamber, indicating an interaction between filaments and the ion waves. Dissert. Abstr.

N80-28188 California Univ., Berkeley.
EQUILIBRIUM AND STABILITY IN STRONGLY INHOMOGENEOUS PLASMAS Ph.D. Thesis
Harry Elliot Mynick 1979 222 p
Avail: Univ. Microfilms Order No. 8014826

In some confinement schemes of current interest, for example in conventional and field-reversed mirrors, and in the Tormac sheath, the parameter eta, defined as the ratio of ion gyroradius to the plasma scale length perpendicular to the magnetic field, may take on appreciable values, as large as 1/3. Formalisms appropriate to the study of such strongly inhomogeneous plasmas are developed and applied, for three general aspects of plasma behavior. Each of these three topics is studied using Hamiltonian formalism, which greatly aids in expressing results in a general and concise manner. The formalism is phrased in terms of variational principle which, in addition to serving as a labor-saving device in parameter regimes where use of a finite-order differential equation is an adequate approximation to the full nonlocal mode equation, also permits the derivation of valid dispersion equations when the problem is fully nonlocal in character. Dissert. Abstr.

N80-28189 Cornell Univ., Ithaca, N. Y.
PRODUCTION AND INVESTIGATION OF A MULTI-AMPHERE POSITRON SOURCE Ph.D. Thesis
Gerald Louis Ferrentino 1980 141 p
Avail: Univ. Microfilms Order No. 8015671

The influence of collective effects on the generation and acceleration of positrons at high current densities is examined and a plasma diagnostic method is demonstrated from an appropriately designed multi-ampere positron source. The source developed has a known energy and angular spread, with a current density of several amperes per square centimeter. A positron current of approximately 15 amperes was produced by bombarding a tantalum target with a pulsed intense relativistic electron beam (IREB). The measured electron-to-positron-conversion yield agreed quantitatively with published low-current values. In a second experiment, the collective acceleration of positrons was investigated by installing a special target assembly that allowed a portion of the unneutralized IREB into air (P approximately less than 100 millitorr) in the vicinity of the positrons. Substantial changes in the positron-energy spectrum and a 60-fold increase of positron signal were observed. Discussions of pair-production, experimental apparatus, and beam-plasma interactions are included. Dissert. Abstr.

N80-28190 California Univ., Berkeley.
NONLINEAR WAVE EVOLUATION IN VLASOV PLASMA. A LIE TRANSFORM Ph.D. Thesis
John Robert Cary 1979 291 p
Avail: Univ. Microfilms Order No. 8014828

Nonlinear wave evolution in Vlasov plasma is analyzed using the Lie transform, a powerful mathematical tool which is applicable to Hamiltonian systems. A useful relation between the ponderomotive Hamiltonian (the kinetic generalization of the ponderomotive potential) and the linear susceptibility of Vlasov plasma, a general formula for the second order, self consistent quasistatic density perturbation produced by a wave packet. For a plasma with one species of single charged ions this formula includes kinetic effects and applies to both magnetized and unmagnetized plasma. Lie transform theory is then applied to two problems, the first of which is to find the nonlinear wave equation that governs waves in unmagnetized plasma. The calculation shows that the self Faraday rotation effect is comparable to the self precession effect. This fact implies that a measurement of the polarization rotation acquired by a nonlinear electromagnetic wave in passing through a plasma does not determine the self-generated quasistatic magnetic field. The second problem considered is the propagation of a test wave in the system consisting of a plasma and a large amplitude electromagnetic wave. Dissert. Abstr.

N80-28191# Nagoya Univ. (Japan). Inst. of Plasma Physics.
CURRENT-CARRYING PLASMA IN FERROMAK
Kazunari Ikuta Apr. 1980 16 p refs
(IPPJ-458) Avail: NTIS HC A02/MF A01

The unique nature of the magnetic configuration of current-carrying plasma in ferromak is demonstrated and compared with the stellarator configuration. The presence of magnetic islandes in the ferromak configuration is suggested. J.M.S.

N80-28192# Nagoya Univ. (Japan). Inst. of Plasma Physics.
REFLECTION OF OBLIQUE ELECTRON THERMAL MODES IN AN INHOMOGENOUS PLASMA
T. Ohnuma (Tohoku Univ.), T. Watanabe (Hiroshima Univ.), and H. Sanuki Apr. 1980 12 p refs
(IPPJ-457) Avail: NTIS HC A02/MF A01

In an inhomogeneous magnetoplasma, reflection of an oblique electron thermal mode radiated from a local source is investigated experimentally and theoretically near the electron plasma frequency layer. The experimental observation of reflection in the lower plasma density region rather than the electron plasma frequency layer is found to be in qualitative accord with the theoretical reflection, which is obtained from a kinetic theory in an inhomogeneous magnetoplasma. The reflection of the thermal mode is also compared with that of an electromagnetic mode at the electron plasma frequency layer. Author

N80-28193*# National Aeronautics and Space Administration, Washington, D. C.
COMPTOMIZATION AND RADIATION SPECTRA OF X-RAY SOURCES. CALCULATION OF THE MONTE CARLO METHOD
L. A. Pozdnyakov, I. M. Sobol, and R. A. Sonyayev Jun. 1980 10 p refs Transl. into ENGLISH of "Komptonizatsiya i Spektra Izlucheniya Rentgenogskikh Istochnikov. Raschety Metoda Monte Karlo", Rept. Pr-447 Acad. of Sci. USSR, Moscow, 1978 12 p Transl. by Scientific Translation Service, Santa Barbara, Calif. (Contract NASw-3198)
(NASA-TM-76181; Pr-447) Avail: NTIS HC A02/MF A01 CSCL 20I

The results of computations of the Comptomization of low frequency radiation in weakly relativistic plasma are presented. The influence of photoabsorption by iron ions on a hard X-ray spectrum is considered. Author

N80-28194# Nagoya Univ. (Japan). Inst. of Plasma Physics.
RESONANT INTERACTION OF SOLITONS AND ZAKHAROV-SHABAT THEORY
Fujio Kako and Nobuo Yajima Apr. 1980 11 p refs
(IPPJ-456) Avail: NTIS HC A02/MF A01

Resonant interaction of solitons is studied in detail for the Kadomtsev-Petviashvili equation. Resonance solutions are discussed in the framework of the Zakharov-Shabat theory. The

breakdown of the Zakharov-Shubat theory associated with the soliton-resonance is not essential and can be avoided. Author

N80-28195# Nagoya Univ. (Japan). Inst. of Plasma Physics.
COMPARATIVE STUDY OF ENERGY ACCOUNTING FOR HEAVY ION FUSION WITH VARIOUS DRIVER ACCELERATORS
S. Kawasaki (Kanazawa Univ.) and A. Miyahara Apr. 1980 18 p refs
(IPPJ-454) Avail: NTIS HC A02/MF A01

Typical designs of driver heavy ion accelerator systems are compared with regard to their 'energy payback time' versus 'cost of construction'. The detailed analyses show that the energy investment for the construction of the Heavy Ion Fusion power station is somewhat smaller than the energy produced by the station in its lifetime, in spite of the large scale of its hardware. The situation could be more favorable than, or at least comparable with, the case of magnetically confined fusion. L.F.M.

N80-28196# Nagoya Univ. (Japan). Inst. of Plasma Physics.
SURFACE STUDY OF FUSION RESEARCH IN UNIVERSITIES LINKAGE ORGANIZATION
Akira Miyahara Apr. 1980 41 p refs Presented at the Japan-US Joint Seminar Mater. Res. Effects in the Fusion Environ., Argonne, Ill., 7-10 Jan. 1980
(IPPJ-455) Avail: NTIS HC A03/MF A01

Progress in surface studies for the nuclear fusion research is reported emphasizing studies on the surface process and the surface damage. In the case of the surface process studies, recycling of hydrogen isotopes, desorption of gaseous light impurities, sputtering, blistering, arcing, and other surface processes are main concerns. On the other hand, for the surface damage studies, the problems are defined by the conceptual fusion reactor design study. These are classifications of the damage mechanism, the superposition of multiple damage effects, the study of modified surfaces produced by plasma irradiation and the surface erosion rate. J.M.S.

N80-28197# Nagoya Univ. (Japan). Inst. of Plasma Physics.
HEAT TRANSPORT DUE TO THE COLLISIONLESS TEARING INSTABILITIES
I. Katanuma May 1980 36 p refs
(IPPJ-461) Avail: NTIS HC A03/MF A01

Collisionless tearing instabilities and the associated electron heat transport are investigated by using a two-and-one-half dimensional particle simulation code. It is shown that a collisionless drift tearing instability saturates at a low amplitude and turns into a nonlinear pure tearing instability. The electron internal energy profile is flattened within the magnetic island. The electron heat conductivity obtained from the heat flow across the singular surface is proportional to W(4) in the linear phase and to (dW/dt)W squared in the nonlinear phase of the tearing instability. Here W is the half width of the magnetic island. A theoretical model to explain these results is also presented. Author

N80-28198# Nagoya Univ. (Japan). Inst. of Plasma Physics.
INTERACTION OF ION-ACOUSTIC SOLITONS IN TWO-DIMENSIONAL SPACE
Fujio Kako and Nobuo Yajima Apr. 1980 36 p refs
(IPPJ-459) Avail: NTIS HC A03/MF A01

Nonlinear evolutions of a two dimensional ion-acoustic wave system are studied analytically and numerically. The solution describing the resonant interaction of three solitons in two-dimensional space is obtained under the approximation of long wavelength and small but finite amplitude. Numerical solutions reveal an importance of soliton resonances in nonlinear developments of two dimensional ion acoustic waves. Author

N80-28199# Naval Research Lab., Washington, D. C. Plasma Physics Div.
STEADY STATE MAGNETIC DIFFUSION FROM RESISTIVE INTERCHANGE MODES
Wallace M. Manheimer 5 Mar. 1980 10 p refs
(AD-A083915; NRL-MR-4173) Avail: NTIS HC A02/MF A01 CSCL 20/9

It is shown that a likely nonlinear state for resistive interchange modes is one in which velocity vortex structure is balanced in Ohmic dissipation. Macroscopically this is manifested as magnetic diffusion and anomalous energy transport. The results are discussed and compared with recent experiments. GRA

N80-28200# Naval Research Lab., Washington, D. C. Lab. for Computational Physics.
ACCURATE ANALYTIC APPROXIMATIONS AND NUMERICAL SOLUTIONS FOR THE STRUCTURE OF QUASI-STATIC LASER DRIVEN ABLATION LAYERS
Joseph H. Orens 29 Feb. 1980 23 p refs Sponsored in part by DOE
(AD-A083913; NRL-MR-4167) Avail: NTIS HC A02/MF A01 CSCL 20/9

Time dependent simulations of a laser driven accelerating shell and ablation layer have shown the presence of long lived quasi-static density and pressure profiles. This paper models the equilibrium solutions for a laser ablation layer both analytically and numerically and develops a detailed understanding of the nature of this flow. Such a model enables the calculation of the quantitative dependence of the shell thickness and acceleration, the peak density, velocity, and temperature of the shell, the width of the Rayleigh-Taylor region, and the distance to the critical surface on the total plasma mass, the critical density, and the absorbed and reflected laser flow. GRA

N80-28201# Saint Louis Univ., Mo. X-ray Optics Lab.
CATOPTRICAL X-RAY OPTICAL SYSTEM FOR USE IN LASER-FUSION DIAGNOSTICS Annual Technical Report, 1 Oct. 1978 - 31 Sep. 1979
James F. McGee Dec. 1979 31 p refs
(Grant AF-AFOSR-3480-78; AF Proj. 2301)
(AD-A084688; AFOSR-80-C334TR) Avail: NTIS HC A03/MF A01 CSCL 20/8

A compound X-ray imaging device is being developed as an aid in the diagnostics of the laser fusion implosion process which involves a pellet of the order of 100 microns in diameter. Ideally, both temporal and spacial information is being sought. This report deals mainly with the removal of spherical aberration from a single X-ray optical element by means of a surface figure which is described by a polynomial of third order and higher. Such an X-ray focuSing element would be useful in an X-ray Streak camera for obtaining temporal information. Combinations of other higher-order surfaces and aperture stops will be used in a compound imaging-device in the attainment of spacial information with sub-micron resolution. Attention is given to the generation and testing of such high-order surfaces. A specially designed surface generator and lapping machine is described. GRA

N80-28202# Massachusetts Inst. of Tech., Cambridge. National Magnet Lab.
LASER-PRODUCED PLASMAS AND RADIATION SOURCES Final Report, 1 Jul. 1975 - 30 Sep. 1979
D. W. Scudder and Hernan C. Praddaude 31 Jan. 1980 168 p refs
(Contract F44620-76-C-0002; AF Proj. 2301)
(AD-A084201; AFOSR-80-0335TR) Avail: NTIS HC A08/MF A01 CSCL 20/9

The research performed under this program has covered a broad range of subjects involving laser interaction with both gaseous and solid target laser plasmas, and with development of plasma diagnostic techniques suitable for our laser-produced plasmas. Included are detailed descriptions of research activities during fiscal years 1978 and 1979. These include a study of stimulated Brillouin scattering in transverse magnetic fields; development of X-ray diagnostics including X-ray continuum measurements, spectroscopy, and imaging techniques and their use in studying solid target plasmas; development of a fast schlieren photography system; and a theoretical study of nonlinear scattering techniques for plasma diagnostics. GRA

N80-28203# Berkeley Research Association, Calif.
A POWER MODEL FOR PLASMA CONVECTION Final Report, 1 Jan. 1978 - 31 Mar. 1979
Joseph B. Workman, S. Y. Chu, and John R. Ferrante 1 Apr. 1979 63 p refs
(Contract DNA001-78-C-0092)
(AD-A084653; AD-E300766; PD-BRA-79-201; DNA-4927F)
Avail: NTIS HC A04/MF A01 CSCL 20/9

A model for simulating the convection of plasma microstructure has been constructed. Labeled 'striation convection,' the procedure is based on the conservation of the square of plasma density or 'plasma power'. The model is driven by a previously developed gradient drift microstructure model. Integrated with other plasma numerical routines, simulation results for several two dimensional F-layer scenarios are presented. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-28204 Cornell Univ., Ithaca, N. Y.
PULSED NMR AND ZERO SOUND MEASUREMENTS IN SUPERFLUID HELIUM-THREE Ph.D. Thesis
Russell Whitney Giannetta 1979 136 p
Avail: Univ. Microfilms Order No. 8015672

Pulsed nuclear magnetic resonance experiments were performed in the A and B phases of superfluid 3He, at pressures of 23 and 27 Bar. Measurements of H3-B spin susceptibility, He3-A dipole frequency, and nonlinear frequency shifts in both phases all agree well with previous measurements. Additional, unexplained spin motions in H3-B were also observed. Spin relaxation studies are consistent with those of Corrucini and Osheroff and Webb in He3-A, but differ considerably in H3-B. Using large angle RF pulses, anomalous frequency shifts were observed, whose persistence indicated new, metastable resonances in He3-A. The measurements are in excellent agreement with those of Bozler et. al. The soliton lattice model of Bruinsma and Maki is discussed and compared with the experimental results. In most respects, the model accurately fits the data. Preliminary results of zero sound measurements in H3-B are also discussed. At low pressures, evidence is presented for a separation of pair-breaking and collective mode contributions to 10 MHz zero sound attenuation. Moreover, the oscillations in attenuation with temperature, first observed by Paulson and Wheatley were observed. Finally, measurements of sound attenuation and velocity at 50 MHz revealed unexpected structure as a function of temperature. Dissert. Abstr.

N80-28205 California Univ., Berkeley.
EXPERIMENTAL STUDIES OF EXCITED METALLIC PHASES IN STRESSED GERMANIUM Ph.D. Thesis
John Elson Furneaux 1979 156 p
Avail: Univ. Microfilms Order No. 8014689

Various experimental aspects of the strain-confined electron hole liquid (SCEHL),which forms when photoexcited carriers flow into a strain potential well created by suitably inhomogeneously stressing Ge, are discussed. The formation process for the SCEHL was examined by time-resolved Alfven wave resonance experiments. The distortion of the SCEHL by a static magnetic field was discovered and studied. Simultaneous infrared imaging and Alfven wave resonance experiments led to the discovery of this magnetostriction of the SCEHL. Further studies using an infrared vidicon and an image scanning apparatus demonstrated that the magnetostriction is caused by the recombination current which is necessary to keep the SCEHL at a constant density even though electron hole pairs within it recombine. The externally applied magnetic field deflects these currents causing an induced magnetic moment and a magnetic contribution to the energy. The total energy of the SCEHL is then minimized by a distortion of the liquid drop usually into an oblate spheroidal shape about the magnetic axis. In addition, the de Haas-van Alfven like magneto-oscillatory luminescence and the equilibrium properties of SCEHL were studied. Dissert. Abstr.

N80-28206 California Univ., Berkeley.
DETERMINATION OF MORPHOLOGY AND ELECTRONIC STRUCTURE IN SOLIDS WITH 20-1000 eV RADIATION Ph.D. Thesis
David Robert Denley 1979 171 p
Avail: Univ. Microfilms Order No. 8014650

The absorption in the extended region of the spectra (EXAFS) is discussed as a technique for structural analysis for: the L sub 2, 3 edge in Ti; the K-edge in microcrystalline, polycrystalline, and monochromator graphite; and the fluorine K-edge of the polymer polyvinylidene fluoride PVF sub 2). The first experiment to use photoyield spectroscopy for an EXAFS structural analysis from a surface is discussed for a surface of oxidized aluminum. The near threshold absorption spectra for the Ti L-edges, the Ag M sub 4, 5, the graphite C K-edge, and the C K-edge in PVF sub 2 are discussed with respect to their electronic structure. An attempt to show that the absorption is paralleled in the symmetry allowed component of the empty density of states is fairly successful. Additional complications are found to arise from atomic like matrix element effects, large variations in the hole lifetime, and excitonic effects. Examples from the L-edge photoyield of Fe and Cu are also considered. The electronic structure analysis of surfaces and interfaces is discussed using the system GaAs/Ge. Dissert. Abstr.

N80-28207 Cornell Univ., Ithaca, N. Y.
TUNABLE FAR-INFRARED RADIATION GENERATED BY A JOSEPHSON JUNCTION Ph.D. Thesis
Richard Keith Elsley 1977 173 p
Avail: Univ. Microfilms Order No. 8015770

Point contact Josephson junctions were used to generate tunable monochromatic far infrared radiation. The radiation is found to be monochromatic to within the ability to resolve (0.07/cm) and tunable from 2/cm to at least 20/cm and possibly 50/cm. The junctions are in the form of a point contact between two pieces of niobium foil. The foil surfaces guide the radiation away from the contact in a relatively non-resonant manner, allowing the frequency to be tuned merely by varying the DC voltage applied to the junction. The radiation was frequency analyzed using a far infrared interferometer and the radiation's linewidth was resolved. Transmission spectroscopy using the junction source was performed on absorption lines in solids at frequencies from 8/cm to 20/cm and the results compared to measurements made by other means. The performance of the junction source was compared to an equivalent circuit model which predicts power output, linewidth, and harmonic content of the radiation. Dissert. Abstr.

N80-28208 Ohio State Univ., Columbus.
THE PHASE DIAGRAM AND MAGNETIZATION OF SUPER FLUID 3HE Ph.D. Thesis
Jan David Feder 1980 193 p
Avail: Univ. Microfilms Order No. 8015875

The procedure and results of a series of experiments designed to measure the phase boundaries and the magnetization of the superfluid phases of (3)He are described. Measurements were performed at five pressures below the polycritical pressure of 21.5 bar. Magnetization data were obtained from continuous wave nuclear magnetic, resonance spectra by integrating the absorption signals. Phase boundaries were determined from the magnetization discontinuities induced by the phase transitions. The magnetization results were found to be in close agreement with the predictions of Bardeed-Cooper-Schrieffer theory suitably-corrected for Fermi liquid effects except at the lowest pressures (0 and 3 bar), where the data indicate a non linear magnetization vs. field relation. The data were reduced to yield the latent heat at the A - B transition, the molar volume difference in the two superfluid phases, and the zero field difference in the Gibbs potentials of the two phases. The Gibbs potential difference were extrapolated to the T approaches T sub c limit to extract the zero field difference in the specific heats of the A and B phases at T sub c. The specific heat results were compared with the predictions of weak coupling theory, and with two strong coupling theories. Dissert. Abstr.

N80-28209 Cornell Univ., Ithaca, N. Y.
A MONTE CARLO STUDY OF CRYSTALLIZATION AND CRYSTALLINE ORDER IN SIMPLE TWO-DIMENSIONAL SYSTEMS Ph.D. Thesis
Robert Charles Gann 1979 150 p
Avail: Univ. Microfilms Order No. 8015773

Monte Carlo simulation, lattice dynamics in the harmonic approximation, and solution of the hypernetted chain integral equation were used to study the classical, two dimensional, one component plasma. The solid phase shows directional long-range order. In the solid phase, positional long-range order is lost as

the thermodynamic limit is approached. The results of the calculation of the thermodynamic functions and the one and two particle distribution functions are presented. The results are compared to the system of particles interacting via an inverse twelfth-power potential. Dissert. Abstr.

N80-28210 Princeton Univ., N. J.
DYNAMICAL SYMMETRY BREAKING IN LATTICE GAUGE THEORIES Ph.D. Thesis
Benjamin Svetitsky 1980 97 p
Avail: Univ. Microfilms Order No. 8015408

Dynamical breaking of chiral symmetry in quantum chromodynamics defined on a spatial lattice is investigated. The formulation respects chiral symmetry by employing a long range gradient for the fermion field. In the strong-coupling limit all states with non zero electric flux are at very high energy, so that the set of degenerate ground states is comprised of all fermionic configurations which are color singlets site by site. An effective Hamiltonian is derived for the 'mesons' in perturbation theory about this limit. Color and flavor are shown to be inessential and the U(1) guage theory is considered with one flavor of four component fermions. The effective Hamiltonian is that of an antiferromagnet whose symmetry group is determined by the dimensionality of space. It is shown that if all but nearest neighbor interactions is dropped the resulting SU(4) antiferromagnet realizes some or all of its symmetry generators in Nambu-Goldstone mode. It is hypothesized that this physics survives when one breaks the SU(4) with non nearest neighbor terms, and this is checked for the one dimensional theory with an explicit block-spin calculation. Dissert. Abstr.

N80-28211 California Univ., Berkeley.
ELECTRON SPECTROSCOPY STUDIES OF CLEAN OXIDE SURFACES, CHEMISORBED MOLECULES AND PHOTO-ASSISTED SURFACE PROCESSES Ph.D. Thesis
Wei Jen Lo 1979 210 p
Avail: Univ. Microfilms Order No. 8014781

Various surface analytic techniques were used to characterize the surface properties of TiO2 and SrTiO3. The chemisorption of molecules on these surfaces and the photo-induced effects on the adsorbed molecules were also examined. Surface chemical composition, electronic properties, and concentration of Ti(3) ions as well as the dissociation of water into hydrogen and oxygen at the solid-gas interface were among the topics studied. Dissert. Abstr.

N80-28212 California Univ., Berkeley.
ELECTRONS ON THE SURFACE OF LIQUID HELIUM Ph.D. Thesis
David Kay Lambert 1979 118 p
Avail: Univ. Microfilms Order No. 8014769

Spectroscopic techniques were used to study transitions of electrons between bound states in the potential well near a helium surface. The charge density distribution of electrons on the surface was independently obtained from electrical measurements. The interaction of the bound state electrons with the surface of liquid helium and local disorder in the positions of electrons on the surface were examined. Results indicate that the distribution of charge on the helium surface is appreciable only within a 'charge pool' that does not in general cover the entire surface and that the distribution of charge in the charge pool can be obtained from electrostatics. Dissert. Abstr.

N80-28213 California Univ., Berkeley.
X-RAY ABSORPTION STUDIES OF GRAPHITE INTERCALATES AND METAL-AMMONIA SOLUTIONS Ph.D. Thesis
Alan Spence Robertson 1979 245 p
Avail: Univ. Microfilms Order No. 8014858

The features in the region near the onset of the K-shell absorption edge, which has been termed X-Ray Absorption Edge Spectroscopy (XAES), are transitions into the unoccupied molecular orbitals or metallic bands of the element being studied. On the high energy side of the absorption edge, the oscillatory portion of the absorption coefficient, which has been labelled Extended X-Ray Absorption Fine Structure (EXAFS), can be analyzed to provide a local radial distribution function around the element being studied. The As-F distances obtained for AsF3 and AsF5 gas are both in excellent agreement with electron diffraction data (within 0.004 A). A superior measurement which is significantly shorter than the accepted value of the bond distance in an undistorted AsF6-octahedra is reported. Both the XAES and EXAFS data presented support the hypothesis that the AsF5 oxidizes graphite upon intercalation to produce AsF6-and AsF3 intercalant species. Changes in the Rb K-edge features which are consistent with the known properties of Rb-NH3 are correlated with conductivity and delocalization of the solvated electons. In the XAES region, the Rb-N bond distance and the relative number of nitrogen atoms in the first shell are measured. Dissert. Abstr.

N80-28214 California Univ., Berkeley.
SUPERCONDUCTOR INSULATOR SUPERCONDUCTOR QUASIPARTICLE TUNNEL JUNCTIONS AS MICROWAVE RECEIVERS Ph.D. Thesis
Tek-Ming Shen 1979 107 p
Avail: Univ. Microfilms Order No. 8014875

The rapid onset of quasiparticle tunneling current in superconductor insulator-superconductor junctions at voltages above 2 delta/e, used for millimeter wave heterodyne mixing is discussed. Junctions with 2 micron diameter and R sub N = 50 omega have little capacitive shunting at the signal frequency of 36 GHz. Because there is no series resistance, residual capacitance can be tuned out. Single sideband conversion efficiencies of 0.16 and mixer noise temperatures as low as T sub M < or = 14K = 8.h nu/k have been observed. The results are compared with shot noise limited mixer theory. Photon assisted tunneling effects are seen which indicate the approach to photon noise-limited operation. The quantum theory of mixing is reviewed and an intuitive picture illustrating the physical significance of the quantum theory is presented. The experimental results are in good agreement with computer simulations using shot noise limited quantum theory. The theoretical model an ideal switch mixer has been experimentally explored and its mixing performance in the quantum limit is investigated. Fundamental limits of a heterodyne mixer using tunneling devices and possible future developments are discussed. Dissert. Abstr.

N80-28215 Cornell Univ., Ithaca, N. Y.
PROPERTIES OF SUPERCONDUCTOR-NORMAL METAL-SUPERCONDUCTOR MICROBRIDGES Ph.D. Thesis
John Michael Warlaumont 1980 174 p
Avail: Univ. Microfilms Order No. 8015749

The fabrication and electrical measurement of short, high resistance (R is approximately 1 ohm) superconductor-normal metal-superconductor microbridges is described. The small (length and width as small as 200 nm), planar structures were produced using electron beam lithography and ion beam etching. Lead-copper-lead structures were primarily studied; other materials were also briefly investigated. The small cross section of the bridges resulted in a uniform current distribution in the bridges at all temperatures, thus enabling the experimental determination of the critical current versus temperature relation for all temperatures between T sub c and 0.05 T sub c, where T sub c is the transition temperature of the electrodes. This experimental I sub c (t) relation was found to agree with theoretical predictions based on Usadel's equations. This successful fit of theory to experiment produced a reduced length, l, for each sample; the sample had reduced lengths ranging from 8.2 to 30. The low-voltage current-voltage (I-V) characteristics were studied in detail. It was found that these I-V curves could be characterized by a temperature independent relaxation time tau sub eff; this relaxation time was observed to be proportional to L(2). Dissert. Abstr.

N80-28216 California Univ., Berkeley.
THE DETERMINATION OF ELECTRONIC STATES IN CRYSTALLINE SEMICONDUCTORS AND METALS BY ANGLE-RESOLVED PHOTOEMISSION Ph.D. Thesis
Kenneth Alan Mills 1979 149 p
Avail: Univ. Microfilms Order No. 8014810

Angle-resolved photoemission (ARP) spectroscopy for the detailed experimental investigation of band structures, and its application to both semiconducting and metallic single crystals is examined. Attention is focussed primarily on the actual electromagnetic excitation process; both direct and indirect

transitions are discussed, as are final-state dependent effects, and the influence of parameters such as radiative polarization temperature, sampling depth, and experimental geometry. Variable photon energy spectra are used to map conduction bands for the sigma and sigma' directions in GaAs, and the results are compared with theory. As concerns crystalline metals, the (111) face of Au and Pt, and the (100) and (110) faces of Ag, are studied in detail using high-resolution variable photon energy ARP. Special attention is paid to final-state-induced spectral features, and consideration of both the energy and intensity behavior of such features leads to the construction of a simple physical picture which both explains the observed phenomena and provides a justification for the use of a quasi-free-electron final state dispersion. Dissert. Abstr.

N80-28217 California Univ., Berkeley.
SURFACE PROPERTIES OF ANTIFERROMAGNETIC METALS AND ALLOYS Ph.D. Thesis
Gustavo Jose Mata 1979 61 p
Avail: Univ. Microfilms Order No. 8014799

Some aspects of the surface properties of antiferromagnetic metals are examined which exhibit a periodic variation of the electronic spin density (a spin-density wave). In particular, the possibility that a spin-density wave might exist at the surface of an otherwise paramagnetic metal is addressed. A phenomenological theory is developed to describe the behavior of the amplitude of a spin-density wave (order parameter) when the electron-electron interaction is enhanced in the immediate vicinity of the surface. The free energy of the system under consideration is taken to be a local functional of the order parameter. The analysis shows that for a range of the parameters in the free energy functional, spin-density waves may appear at the surface and decay into a paramagnetic bulk. The parameters of the phenomenological theory are explicitly calculated for a model system and expressions are obtained which involve its microscopic properties. With the help of these expressions the theory is applied to chromium and the chromium-rhenium alloys. Results suggest that surface spin-density waves may exist in these materials at temperatures above the transition temperature corresponding to the bulk. Dissert. Abstr.

N80-28218 California Univ., Berkeley.
INTERACTIONS IN SOLIDS Ph.D. Thesis
Andrei Manoliu 1979 62 p
Avail: Univ. Microfilms Order No. 8014795

The attractive interaction between a magnetic monopole and a ferromagnetic domain was calculated. The complete calculation which includes effects of anisotropy and exchange, gives a result for the interaction energy (referred to the pole at infinity) which is ten percent lower than that obtained by the methods of images. A monopole of unit charge, g = (137/2)e, is found to be attracted by iron, and the interaction energy is about 50 meV. The interaction between phonons and the carriers in the electron-hole drop formed in germanium by optical pumping is discussed. This interaction accounts for the slowing force on the drops in the cloud in their motion to the point of maximum stress in inhomogeneously stressed samples of germanium. The interaction between the large drop, formed in inhomogeneously stressed germanium, and microwave radiation was calculated. It is shown that under steady microwave pumping and steady state illumination the drop heats up above its critical temperature releasing carriers into the crystal. Dissert. Abstr.

N80-28219 Miami Univ., Fla.
ENERGY TRANSPORT IN HARMONIC LATTICES Ph.D. Thesis
Stephan Landers Linn 1979 64 p
Avail: Univ. Microfilms Order No. 8014174

One and two dimensional oscillator systems are constructed so that individual oscillators are bound to their home positions and coupled to nearest neighbors by linear forces; both systems are treated for the case of weak coupling. The two dimensional system has a tensor binding force that does not permit it to be decoupled into two noninteracting sytems. Segments and strips are treated as thermodynamic systems in contact with a heat bath and Gaussian initial probability densities are used to compute correlations. Expressions for entropy and temperature are computed by relating initial system and bath variances to equilibrium temperature. Asymptotic relations for 'temperature' are found that show the degree of coupling between dimensions affects the rate of approach to equilibrium, but only through the coefficient of time and not its power. Both systems approach equilibrium as +/-1 rather than +/-1/2 as predicted by continuum theory. Dissert. Abstr.

N80-28220# Missouri Univ. -Rolla. Dept. of Physics.
OPTICAL STUDIES OF THE INTERFACE STATES AT GaAs-METAL SCHOTTKY BARRIER JUNCTIONS Final Report, 1 Oct. 1975 - 29 Sep. 1978
Robert J. Bell, Ralph W. Alexander, Jr., and Gerald P. Alldredge 1980 35 p refs
(Grant AF-AFOSR-2938-76)
(AD-A083758; AFOSR-80-2938TR) Avail: NTIS
HC A03/MF A01 CSCL 20/12

The goal of the proposed research was to study surface states at GaAs metal Schottky barrier junctions and the effects of oxygen exposure on the surface states using both optical and electrical measurements with the goal of correlating the optical and electrical results. The correlation could not be achieved because the optical measurements were unsuccessful in detecting the surface states. From the electrical measurements, the following results were obtained: oxygen-exposure before the metallization with Al produces a large increase in the surface density of states peaking about 0.28 eV above the Fermi level; Al-GaAs diodes metallized without oxygen exposure had ideality factors of n equal to less than 1.1; Ag-GaAs diodes with oxygen exposure also show a surface state density peaking about 0.3 eV above the Fermi level. However, the surface state density is considerably lower than for oxygen-exposed AlGaAs diodes; Au-GaAs diodes with oxygen exposure show a surface state density which peaks about 0.45 eV above the Fermi level. Again, this density is considerably lower; from the above, oxygen at a GaAs-metal interface plays an important role in determining the surface state density. The theoretical part of this study to calculate electronic energies at GaAs surface was also unsuccessful. GRA

N80-28221# Rockwell International Corp., Thousand Oaks, Calif. Electronics Research Center.
HIGH RESISTIVITY MOLECULAR BEAM EPITAXIAL AlGaAs FOR DEVICE APPLICATIONS Annual Report, 1 May 1978 - 30 Apr. 1979
R. D. Fairman, D. L. Miller, and W. A. Hill Feb. 1980 45 p refs
(Contract N00014-78-C-0370)
(AD-A083778; ERC41006.2AR) Avail: NTIS
HC A03/MF A01 CSCL 07/4

AlGaAs molecular beam epitaxial (MBE) layers suitable for device application, are studied and the results are discussed. Analysis includes Van der Pauw and Hall measurements, photoluminescence, sheet resistance, photoinduced current transient spectroscopy (PITS), secondary ion spectroscopy, and capacitance-voltage profiling. All indications are that high quality buffer layers of AlGaAs and active layers of GaAs can be produced by MBE which can yield devices of exceptional performance. GRA

N80-28222# Michigan Univ., Ann Arbor. Dept. of Chemistry.
INCOHERENT DETECTION OF ULTRASONIC USING THIN FILM AMORPHOUS SEMICONDUCTORS Final Report, 1 Apr. 1976 - 1 Jun. 1979
A. H. Francis Wright-Patterson AFB AFML Nov. 1979 50 p refs
(Contract F33615-76-C-5240; AF Proj. 2306)
(AD-A083285; AFML-TR-79-4170) Avail: NTIS
HC A03/MF A01 CSCL 20/12

Thin film ultrasonic detectors have been fabricated from amorphous germanium. The detectors are insensitive to phase and function as sensitive power detectors for ultrasonic waves. Due to the mode of operation of the detectors, their usefulness is limited to the temperature range 1.5 - 77 K. The dependence of the sensitivity of the devices upon the structural and electrical characteristics of the a-Ge material has been investigated experimentally. It was found that useful performance is obtained only when electrical conduction is by a variable range hopping mechanism. GRA

N80-28223# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
PREPARATION AND CHRACTERIZATION OF INFRARED MATERIALS Final Report, 1 Jan. 1977 - 31 Dec. 1979
August F. Witt 1 Apr. 1980 8 p refs
(Grant AF-AFOSR-3202-77; AF Proj. 2306)
(AD-A084324; AFOSR-80-0414TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

The primary objectives of this research program were: (A) in broad terms, to advance the established processing techniques for growth of IR materials and to improve crystalline perfection and composition control achievable in single crystals to beyond the state of the art and in (B) specific terms; (growth of n-type InSb single crystals with uncontrolled microsegregation variations reduced to less than 10%, growth of heavily doped (Bi) InSb single crystals with optimized composition control, and (3) growth of InSb macro-superlattices, suitable for spin-flip Raman laser structures. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-28224 Purdue Univ., Lafayette, Ind.
A FIBER BUNDLE APPROACH TO UNIFIED FIELD THEORY Ph.D. Thesis
Lawrence Michael Beyl 1979 121 p
Avail: Univ. Microfilms Order No. 8015428

It is shown that the Einstein, Maxwell, and Dirac equations are special cases of a fiber-bundle approach to unified field theory when based on the gauge transformations of the group SU(4/N). This group is rearranged into a modified SU(2,2/N) group which directly contains Dirac generators in the supersymmetry or Fermi part, and is shown to contain the direct product, of SU(2,2) and SU(N) and U(1) in its commuting or Bose part. The action is constructed based on the curvature of the fiber-bundle and is invariant, under space-time coordinate changes and gauge transformations, when integrated over spacetime and group space. A finite change in the gauge, potentials allows the lower spin 0 and spin 1/2 components to enter. Minor changes in the theory allows different chiral contributions to occur in the Dirac equation, favoring left or right handed interactions. No restrictions are given which determine this relationship, but a choice is made to demonstrate the presence of the Dirac equation. The scaling requirements on the electromagnetic and Dirac actions fixes the size of the contribution from the Weyl action for gravity. It is found to be approximately 10 to the 65th power weaker than Einstein's gravitational action and therefore this approach avoids the problems associated with the R + R(2) Lagrangian.
Dissert. Abstr.

N80-28225 Purdue Univ., Lafayette, Ind.
PHASE EQUILIBRIUM OF LIGHT GASES AND HEAVY HYDROCARBONS AT ELEVATED TEMPERATURES AND PRESSURES Ph.D. Thesis
James John Simnick 1979 352 p
Avail: Univ. Microfilms Order No. 8015518

A flow type vapor-liquid equilibrium (VL) apparatus was constructed which enabled measurements to be taken at conditions up to 400 C and 250 atm. Hydrocarbon superambient vapor pressures, binary mixture VLE of light gases with hydrocarbons, and ternary mixture VLE were measured. An augmented hard core equation of state, named the BACK equation, was developed to model the phase behavior of such systems. The BACK equation is efficient in that only three constants are required for most pure fluid behavior description. These constants reflect the hard core volume, interaction energy, and shape of a molecule. Extension to modeling mixture behavior with the BACK equation was made upon introducing mixing rules for the three pure fluid constants. Van der Waals type rules employing one binary energy interaction parameter were determined to be the best precipition. An additional binary hard core volume interaction parameter was found to be necessary for mixtures containing hydrogen. Using the VLE data from this research and from the literature, these parameters were determined for a large number of binary mixtures containing hydrocarbons with methane, carbon dioxide, hydrogen sulfide, or hydrogen. Dissert. Abstr.

N80-28226 California Univ., Berkeley.
A MATHEMATICAL STUDY OF THE NON-RELATIVISTIC LIMIT IN QUANTUM MECHANICS Ph.D. Thesis
Ross Joseph Cirincione 1979 62 p
Avail: Univ. Microfilms Order No. 8014637

Many articles on the nonrelativistic limit in quantum mechanics have been concerned with the convergence of the Dirac equation itself to the Schrodinger (Pauli) equation as c, the speed of light, tends to infinity. The convergence of the solution of the Dirac equation is rigorously analyzed in terms of semi-groups and spectral projections. An abstract Dirac equation with relatively bounded potentials is presented and the convergence of its solution is determined with the aid of a generalization of the Trotter-Kato theorem. Similar results are determined for the convergence of the solution of the Klein-Gordon equation and for an abstract version of this equation. Dissert. Abstr.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-28227# Clemson Univ., S.C. Dept. of Mathematical Sciences.
STATISTICAL METHODS IN SOLE SOURCE CONTRACT NEGOTIATION
K. T. Wallenius 19 Nov. 1979 23 p refs Submitted for publication
(Contract N00014-75-C-0451; NR Proj. 047-202)
(AD-A083983; N111; TR-327) Avail: NTIS HC A02/MF A01 CSCL 05/1

A scenario is described which involves ill-defined elements of conflict and cooperation: the acquisition of military systems by the Department of Defense (DoD) from large corporations. Current practices lead to situations in which DoD must deal with a sole source and thus forego savings which might be realized from competition between contractors. In order to deal with this situation, the Armed Services Procurement Regulations (ASPR) prescribes procedures which must be employed in the analysis and negotiation of sole source price proposals. These time-consuming procedures generate enormous proposal backlogs for government price analysts who, because of time pressure, may not be able to do a sufficiently thorough and accurate analysis upon which to base their negotiation position. This analysis paralysis also causes payment delays which, in turn, force contractors to borrow working capital and suffer capital costs. It is clearly in the best interests of all parties to expedite the processing of these proposals. This has been accomplished by developing statistical sampling and estimation techniques which, unlike some classical procedures, are not vulnerable to exploitation through the use of clever padding strategies. GRA

N80-28228# National Technical Information Service, Springfield, Va.
DATA BASE MANAGEMENT. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1979 - Mar. 1980
Brian Carrigan Apr. 1980 103 p Supersedes NTIS/PS-79/

0384; NTIS/PS-78/0328
(PB80-808165; NTIS/PS-79/0384; NTIS/PS-78/0328) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The advent of on-line systems and the increasing problems of file organization, file maintenance, and file structures of data bases has required the study and development of data base management systems. This bibliography of Federally funded research cites the development of software packages and implementation of data base management systems into various information systems. This updated bibliography contains 96 abstracts, 87 of which are new entries to the previous edition. GRA

N80-28229# National Technical Information Service, Springfield, Va.
DATA BASE MANAGEMENT. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1980
Brian Carrigan Apr. 1980 258 p Supersedes NTIS/PS-79/0385; NTIS/PS-78/0329
(PB80-808173; NTIS/PS-79/0385; NTIS/PS-78/0329) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The advent of on-line systems and the increasing problems of file organization, file maintenance, and file structures of data bases have resulted in the study and development of data base management systems. This bibliography of worldwide literature cites research on the development of software packages and the implementation of data base management systems into various information systems. This updated bibliography contains 251 abstracts, 66 of which are new entries to the previous edition. GRA

N80-28230# National Technical Information Service, Springfield, Va.
DATA BASE MANAGEMENT. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - 1978
Brian Carrigan Apr. 1980 262 p
(PB80-808157) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The advent of on-line systems, and the increasing problems of file organization, file maintenance, and file structures of data bases, has required the study and development of data base management systems. This bibliography of Federally funded research cites the development of software packages and implementation of data base management systems into various information systems. Also cited are guidelines for use in optimizing and modelling data bases. This updated bibliography contains 255 abstracts, none of which are new entries to the previous edition. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-28231 California Univ., Los Angeles.
APPLYING BEHAVIORAL ABSTRACTION TO INFORMATION SYSTEM DESIGN AND INTEGRITY Ph.D. Thesis
Nancy Gail Leveson 1980 152 p
Avail: Univ. Microfilms Order No. 8016007

The practicality and usefulness of defining information systems using behavioral abstraction is explored. The meaning or semantics of the data is defined in the manner of an abstract data type, that is, by the definition of the operations on objects. Preserving the integrity, or correctness, of an object is defined preserving its abstract invariant. Thus specifying integrity involves both specifying the abstract invariant (the static characteristics) and the legal operations specified by pre and post conditions (the behavioral characteristics) which preserve this invariant. A method for verifying the integrity specification of an information system by proving that the abstract operations preserve the invariant and a practical means for enforcing integrity lead naturally from the integrity specification technique. It can be proved that the implementations of the operations are correct with respect to the abstraction, inserting assertions into the implementations when necessary for run-time checking. A well-structured, disciplined methodology, for information system design which supports the use of such techniques as top-down design, information hiding, and code sharing is presented along with the formal specification method. Dissert. Abstr.

N80-28232 California Univ., Los Angeles.
SECURITY IN DATA BASE MANAGEMENT SYSTEMS Ph.D. Thesis
Deborah Downs 1980 229 p
Avail: Univ. Microfilms Order No. 8015964

Several proposed methods of supplying security in data base management systems (DBMS) are examined and conclusions are drawn concerning their suitability. A design for a certifiable, value independent, data secure, DBMS kernel is described. The DBMS kernel supports data security by identifying the data correctly at the domain level and providing a certifiable direct mapping from the logical name of the data (used in the protection data and the user's request) to the physical identity (used at the access method level). Using this basic kernel design a retrofit of the DBMS kernel was developed for Ingres, a relational DBMS. Also included is an abstract model for value independent, data secure DBMSs which can be used as a basis for certifying a DBMS kernel. In order to support the secure DBMS a data secure operating system is needed which allows only the DBMS read access to the data base and the DBMS kernel read and write access. Access to the data base by other processes is prohibited. The data secure operating system must also supply a secure process environment to the DBMS kernel. A correct operating system is needed in order to retrieve exactly the data requested by the DBMS kernel and also only certified operating system code can be included in the DBMS kernel's process space. Dissert. Abstr.

N80-28233 California Univ., Berkeley.
EVALUATION AND ENHANCEMENT OF THE PERFORMANCE OF RELATIONAL DATABASE MANAGEMENT SYSTEMS Ph.D. Thesis
Paula Birdwell Hawthorn 1979 213 p
Avail: Univ. Microfilms Order No. 8014726

In order to determine the performance characteristics of a standard data base system, the performance of the relational data management system INGRES in analyzed. A benchmark analysis technique is used for the performance evaluation. The results show that the performance characteristics of two query types; data-intensive queries and overhead-intensive quries, are so different that it may be difficult to design a single architecture to optimize the performance of both types. Significant sequentially of reference was found in the data-intensive queries. It is shown that back-end data management machines may be cost effective only for data-intensive queries. It is proposed that the best method of distributing the processing of the overhead-intensive query is through the use of intelligent terminals. It is shown that there is significant locality of reference in the multi relation queries. The performance of the INGRES system is compared to estimated performance of serveral database machines. It is found that for significant classes of queries and standard system provides the most cost-effective processing of the queries. Dissert. Abstr.

N80-28234 Washington Univ., Seattle.
ACCESS PATH OPTIMIZATION IN MULTIDIMENSIONALLY ACCESSED DATABASE FILES Ph.D. Thesis
Georges Spiridon Nicolas 1979 153 p
Avail: Univ. Microfilms Order No. 8012200

A general access path model for multidimensionally accessed data base fields is developed. This model is capable of characterizing a large class of file organizations. Three principal access path structures are identified and then used to model a general file organization. This organization supports the multidimensional key access feature and includes all the basic file organizations as special cases. A cost function based on both storage and time costs is developed. This cost function quantitatively measures the performance of the data base system and can also be used to evaluate the efficiency of the various classical file organizations.

Optimization techniques which minimize the cost function by producing an optimal design based on the file organization are developed. The general cost problem is first transformed into a set of three simpler cost problems through a series of decomposition and reduction steps. These simpler cost problems are defined as linear integer programming (LIP) models with binary valued variables. Dissert. Abstr.

N80-28235 California Univ., Berkeley.
A SYSTEMATIC APPROACH TO THE MANAGEMENT OF DATA ON DISTRIBUTED DATA BASES Ph.D. Thesis
Benjamin Wan-Sang Wah 1979 313 p
Avail: Univ. Microfilms Order No. 8014919

Data management issues in particular the query decomposition, the file placement, the task scheduling, and the hardware support issues are analyzed and a unified approach is provided to design data management strategies on distributed data bases. Two complementary techniques are developed in query decomposition so that nondecomposable queries which require the use of multiple files can be decomposed into multiple sub-queries which require the use of a single file. By showing that the file placement problem and the facility location problem are isomorphic, many results derived in one problem can be applied to solve the other problem. Further, some results derived in one problem can be shown to be weaker than the corresponding results derived in the other problem. The task scheduling problem for a distributed system is shown to be NP-complete. However, an optimal average algorithm is developed for a restricted class which minimizes the expected completion time for a set of random requests. In the hardware support issue, the design of an associative memory which is capable of equality, proximity, threshold, and extremum searches is investigated. Dissert. Abstr.

N80-28236# Computer Corp. of America, Cambridge, Mass. Research Div.
SPATIAL DATA MANAGEMENT SYSTEM Quarterly Research and Development Technical Report, 1 Jun. - 31 Aug. 1979
Mark Friedell, David Kramlich, Christopher F. Herot, and Richard Carling 31 Aug. 1979 44 p refs Original contains color illustrations
(Contract MDA903-78-C-0122; ARPA Order 3487)
(AD-A083948) Avail: NTIS HC A03/MF A01 CSCL 05/2

This technical report describes work completed on a prototype Spatial Data Management System (SDMS). The Graphical Display of Data presents an overview of the icon creation mechanisms currently included in SDMS. Icon creation is the facility by which graphical representations of symbolic data are automatically produced. These graphical representations are referred to as 'icons'. Section two includes detailed discussions of the icon creation features added to the system: Secondary data a mechanism by which information in multiple relations or tuples may be presented in a single icon, and a subicons mechanism that allows the appearance of a portion of an icon to be described independently of its parent icon. GRA

N80-28237# Battelle Columbus Labs., Ohio.
MECHANICAL PROPERTIES DATA CENTER Annual Report, 1 Jan. - 31 Dec. 1979
Harold Mindlin, Harold Hucek, and Ross Gubiotti Mar. 1980 60 p
(Contract DLA900-79-C-0539)
(AD-A083123; AMMRC-TR-80-8) Avail: NTIS HC A04/MF A01 CSCL 05/2

This report summarizes MPDC activities for the period 1 January 1979 through 31 December 1979, a total of 12 months, under Contract DLA900-79-C-0539. It provides a summary of the scope, objectives and organization of MPDC, its information processing products, and services, and a discussion of management objectives. The report focuses on the start up of MPDC and the conversion of the mechanical properties data base to the Battelle data base management system engendered by the change of contractors. GRA

N80-28238# California Univ., Los Angeles. School of Management.
AN ARCHITECTURE FOR INFORMATION SYSTEMS MANAGEMENT
Bennet P. Lientz and Myles Chen May 1980 36 p
(Contract N00014-75-C-0266; NR Proj. 049-345)
(AD-A084545) Avail: NTIS HC A03/MF A01 CSCL 05/1

There has been an increased effort in general management and information systems management to organize information systems and computer activities to respond to organization requirements on a more effective and efficient basis. A model of the current information systems architecture is developed and evaluated. Requirements for a new architecture are determined based on user, manager, and technology needs. An information systems organization architecture is then developed. The architecture is related to Nolan's organizational stages of growth, decision support systems, and information resource management. Implementation and several examples of application are discussed. GRA

N80-28239# National Technical Information Service, Springfield, Va.
USER NEED IN DOCUMENTATION AND INFORMATION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Mar. 1980
Mary E. Young Apr. 1980 220 p Supersedes NTIS/PS-79/0407; NTIS/PS-78/0431
(PB80-807910; NTIS/PS-79/0407; NTIS/PS-78/0431) Avail: NTIS HC $30.00/MF $30.00 CSCL 05B

Reports on meeting the needs of the information sciences user in the most direct and specific war are cited, including methods used to determine those needs and measures taken to fulfill them in application to educational resources, data bases, data management, library networks, photographic recording systems, technical information centers, and consulting services. This updated bibliography contains 213 abstracts, 50 of which are new entries to the previous edition. GRA

N80-28240# California Univ., Davis. Dept. of Electrical and Computer Engineering.
IMAGE CODING: REPORT OF A WORKSHOP
V. Ralph Algazi, ed. Sep. 1979 189 p refs Workshop held at Boulder, Colo., 14-16 Dec. 1977
(Grants NSF ENG-77-09121; NSF ENG-78-11521)
(PB80-164817; SIPL-79-5; NSF/RA-790300) Avail: NTIS HC A09/MF A01 CSCL 09D

The state-of-the art in fundamental and applied areas of image coding is addressed. Objectives focus on the following areas: (1) a broad and critical assessment of the state of knowledge in image coding and the trends in image transmission and decoding; (2) a description of the areas of research and experimentation needed for a systematic understanding and implementation of image coding; and (3) a determination of the needed future research both to provide fundamental knowledge and for the use of recent technological advances in image coding. Major emphases is placed on the human observer, image as data sources, the theoretical basis of image coding, a survey of image encoders, and a survey of applications and implementations. GRA

N80-28241# Executive Office of the President, Washington, D. C. Office of Administration.
REPORT OF THE ADVISORY COMMITTEE ON INFORMATION NETWORK STRUCTURE AND FUNCTIONS FOR THE EXECUTIVE OFFICE OF THE PRESIDENT
Feb. 1980 64 p refs
(PB80-165673) Avail: NTIS HC A04/MF A01 CSCL 05B

An information network proposed for the Executive Office of the President (EOP) is described. The EOP information Network is defined as consisting of all nonmission oriented information processing and data communication services along with supporting software and hardware systems that are centrally administered and common to the EOP user community. This network is moreover viewed as a center of stability or city plan, which permits the orderly evolution of EOP information systems along any one of several diverse alternatives, as dictated by technology, user needs, and the increasing trends toward resource decentralization. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-28242# Committee of Conference (U. S. Congress).
AUTHORIZING APPROPRIATIONS TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington GPO 1980 11 p Rept. to accompany S. 2240 presented by the Comm. of Conf. at the 96th Congr., 2nd Sess., 27 Jun. 1980
(HR-Rept-96-1142; GPO-64-512) Avail: US Capitol, House Doc. Room

A summary of the adjustments made to the original amendment concerning the FY-81 appropriations to NASA for research and development, construction of facilities, and research and program management is given. The points in disagreement between the House and Senate autorizations, and the committee of conference resolutions are outlined. M.G.

N80-28243# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1981, VOLUME 4
Washington GPO 1980 852 p Hearings on H.R. 6413 before the Subcomm. on Space Sci. and Appl. of the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., no. 111, 5-7, 11, 14-16, 18 Feb. 1980
(GPO-61-147) Avail: Subcomm. on Space Sci. and Appl.

Budget requests for space transportation systems and their operations are examined with particular emphasis on the shuttle main engine and thermal protection system. LANDSAT technology and its effect on the AgRISTARS project are discussed as well as progress in the development of solar electric propulsion and electric hybrid automobiles. The international solar polar mission, continued support for other space missions, and the tracking and data relay satellite systems are also considered. A.R.H.

N80-28244# General Accounting Office, Washington, D. C. International Div.
US ENERGY ASSISTANCE TO DEVELOPING COUNTRIES: CLARIFICATION AND COORDINATION NEEDED Report to the Congress
28 Mar. 1980 72 p
(PB80-162720; ID-80-7) Avail: NTIS HC A04/MF A01 CSCL 05D

An assessment of U.S. energy assistance to developing countries is given. Primary Federal agencies involved include the Departments of State and Energy, the International Development Cooperation Agency, and the Agency for International Development. Energy assistance activities could be improved with the establishment of comprehensive U.S. policy, clarification of the roles and relationships of the agencies, and better coordination among involved agencies and international organizations. GRA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see 03 Air Transportation and Safety, 16 Space Transportation, and 44 Energy Production and Conversion.

N80-28245*# Fiat Research Center, Orbassano (Italy).
PHASE 1 OF THE NEAR TERM HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM Final Report
P. Montalenti and R. Piccolo 21 Sep. 1979 143 p refs
(Contract JPL-955197)
(NASA-CR-163219; JPL-9950-330) Avail: NTIS HC A07/MF A01 CSCL 13F

In order to meet project requirements and be competitive in the 1985 market, the proposed six-passenger vehicle incorporates a high power type Ni-Zn battery, which by making electric-only traction possible, permits the achievement of an optimized control strategy based on electric-only traction to a set battery depth of discharge, followed by hybrid operation with thermal primary energy. This results in a highly efficient hybrid propulsion subsystem. Technical solutions are available to contain energy waste by reducing vehicle weight, rolling resistance, and drag coefficient. Repoacing new 1985 full size vehicles of the conventional type with hybrids of the proposed type would result in a U.S. average gasoline saving per vehicle of 1,261 liters/year and an average energy saving per vehicle of 27,133 MJ/year. A.R.H.

N80-28246*# Fiat Research Center, Orbassano (Italy).
PHASE 1 OF THE NEAR TERM HYBRID PASSENGER VEHICLES DEVELOPMENT PROGRAM. APPENDIX A: MISSION ANALYSIS AND PERFORMANCE SPECIFICATION STUDIES, VOLUME 1 Final Report
M. Traversi and L. A. C. Barbarek (Illinois Inst. of Technology) 20 Apr. 1979 157 p
(Contract JPL-955187)
(NASA-CR-163220; JPL-9950-330) Avail: NTIS HC A08/MF A01 CSCL 13F

Applicable data was categorized and processed according to vehicle usage and trip parameters with consideration of payload (cargo, people, size) and driving cycles. A mission that maximizes the fuel potential savings for the total 1985 vehicle fleet was selected. Mission requirements that have a bearing on conventional and hybrid vehicle performance and characteristics were identified and formulated and a reference ICE vehicle was selected that meets or exceeds all requirements while maintaining within applicable constraints. Specifications for vehicle performance were established based on mission requirements, mission related vehicle characteristics, and fuel consumption. A.R.H.

N80-28247*# Fiat Research Center, Orbassano (Italy).
PHASE 1 OF THE NEAR TERM HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM, APPENDIX A. MISSION ANALYSIS AND PERFORMANCE SPECIFICATION STUDIES. VOLUME 2: APPENDICES Final Report
M. Traversi and L. A. C. Barbarek (Illinois Inst. of Technology) 18 May 1979 83 p
(Contract JPL-955187)
(NASA-CR-163221; JPL-9950-330) Avail: NTIS HC A05/MF A01 CSCL 13F

A handy reference for JPL minimum requirements and guidelines is presented as well as information on the use of the fundamental information source represented by the Nationwide Personal Transportation Survey. Data on U.S. demographic statistics and highway speeds are included along with methodology for normal parameters evaluation, synthesis of daily distance distributions, and projection of car ownership districutions. The synthesis of tentative mission quantification results, of intermediate mission quantification results, and of mission quantification parameters are considered and 1985 in place fleet fuel economy data are included. A.R.H.

N80-28248*# Fiat Research Center, Orbassano (Italy).
PHASE 1 OF THE NEAR TERM HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM. APPENDIX B: TRADE-OFF STUDIES, VOLUME 1 Final Report
M. Traversi and R. Piccolo 11 Jun. 1980 131 p
(Contract JPL-955187)
(NASA-CR-163222; JPL-9950-330) Avail: NTIS HC A07/MF A01 CSCL 13F

Tradeoff study activities and the analysis process used are described with emphasis on (1) review of the alternatives; (2) vehicle architecture; and (3) evaluation of the propulsion system alternatives; interim results are presented for the basic hybrid vehicle characterization; vehicle scheme development; propulsion system power and transmission ratios; vehicle weight; energy consumption and emissions; performance; production costs; reliability, availability and maintainability; life cycle costs, and operational quality. The final vehicle conceptual design is examined. A.R.H.

N80-28249*# Fiat Research Center, Orbassano (Italy).
PHASE 1 OF THE NEAR TEAM HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM. APPENDIX C: PRELIMINARY DESIGN DATA PACKAGE, VOLUME 1 Final Report
R. Piccolo 31 Jul. 1979 259 p
(Contract JPL-955187)
(NASA-CR-163223; JPL-9950-330) Avail: NTIS HC A12/MF A01 CSCL 13F

The methodology used for vehicle layout and component definition is described as well as techniques for system optimization and energy evaluation. The preliminary design is examined with particular attention given to body and structure; propulsion system; crash analysis and handling; internal combustion engine; DC motor separately excited; Ni-Zn battery; transmission; control system; vehicle auxiliaries; weight breakdown, and life cycle costs. Formulas are given for the quantification of energy consumption and results are compared with the reference vehicle. A.R.H.

N80-28250*# Fiat Research Center, Orbassano (Italy).
PHASE 1 OF THE NEAR TERM HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM. APPENDIX B: TRADE-OFF STUDIES. VOLUME 2: APPENDICES Final Report
M. Traversi and R. Piccolo 15 Jun. 1979 51 p
(Contract JPL-955187)
(NASA-CR-163224; JPL-9950-330) Avail: NTIS HC A04/MF A01 CSCL 13F

The SPEC '78 computer program which consists of mathmatical simulations of any vehicle component and external environment is described as are configuration alternatives for the propulsion system. Preliminary assessments of the fundamental characteristics of the lead-acid and sodium-sulfur batteries are included and procedures are given for estimating the cost of a new vehicle in mass production. A.R.H.

N80-28251*# Fiat Research Center, Orbassano (Italy).
PHASE 1 OF THE NEAR TEAM HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM. APPENDIX C: PRELIMINARY DESIGN DATA PACKAGE. VOLUME 2: APPENDICES Final Report
R. Piccolo 11 Sep. 1979 124 p
(Contract JPL-955187)
(NASA-CR-163225; JPL-9950-330) Avail: NTIS HC A06/MF A01 CSCL 13F

The design, development, efficiency, manufacturability, production costs, life cycle cost, and safety of sodium-sulfur, nickel-zinc, and lead-acid batteries for electric hybrid vehicles are discussed. Models are given for simulating the vehicle handling quality, and for finding the valuve of: (1) the various magnetic quantities in the different sections in which the magnetic circuit of the DC electric machine is divided; (2) flux distribution in the air gap and the magnetization curve under load conditions; and (3) the mechanical power curves versus motor speed at different values of armature current. A.R.H.

N80-28252*# Fiat Research Center, Orbassano (Italy).
PHASE 1 OF THE NEAR TERM HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM. APPENDIX D: SENSITIVITY ANALYSIS Final Report
M. Traversi 3 Jul. 1979 50 p
(Contract JPL-955187)
(NASA-CR-163226; JPL-9950-330) Avail: NTIS HC A03/MF A01 CSCL 13F

Data are presented on the sensitivity of: (1) mission analysis results to the boundary values given for number of passenger cars and average annual vehicle miles traveled per car; (2) vehicle characteristics and performance to specifications; and (3) tradeoff study results to the expected parameters. A.R.H.

N80-28253*# North Carolina Science and Technology Research Center, Research Triangle Park.
A REGIONAL TECHNOLOGY TRANSFER PROGRAM Final Report, 1 Jan. - Dec. 1979
31 Dec. 1979 37 p
(Contract NASw-3055)
(NASA-CR-163360) Avail: NTIS HC A03/MF A01 CSCL 05B

The proliferation of online searching capabilities among its industrial clients, changes in marketing staff and direction, use of Dun and Bradstreet marketing service files, growth of the Annual Service Package program, and services delivered to clients at the NASA funded North Carolina Science and Technology Research Center are described. The library search service was reactivated and enlarged, and a survey was conducted on the NC/STRC Technical Bulletin's effectiveness. Several quotations from clients assess the overall value of the Center's services. A.R.H.

N80-28254*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY RESULTS OF STEADY STATE CHARACTERIZATION OF NEAR TERM ELECTRIC VEHICLE BREADBOARD PROPULSION SYSTEM
Noel B. Sargent Jul. 1980 10 p
(Contract EC-77-A-31-1011)
(NASA-TM-81546; DOE/NASA/1011-31; E-502) Avail: NTIS HC A02/MF A01 CSCL 13F

The steady state test results on a breadboard version of the General Electric Near Term Electric Vehicle (ETV-1) are discussed. The breadboard was built using exact duplicate vehicle propulsion system components with few exceptions. Full instrumentation was provided to measure individual component efficiencies. Tests were conducted on a 50 hp dynamometer in a road load simulator facility. Characterization of the propulsion system over the lower half of the speed-torque operating range has shown the system efficiency to be composed of a predominant motor loss plus a speed dependent transaxle loss. At the lower speeds with normal road loads the armature chopper loss is also a significant factor. At the conditions corresponding to a cycle for which the vehicle system was specifically designed, the efficiencies are near optimum. M.G.

N80-28256*# Eaton Engineering and Research Center, Southfield, Mich.
SMALL PASSENGER CAR TRANSMISSION TEST-CHEVROLET 200 TRANSMISSION Final Report
M. P. Bujold Mar. 1980 381 p
(Contracts DEN3-124; EC-77-A-31-1044)
(NASA-CR-159835; DOE/NASA/0124-1; ERC-L1B-79168)
Avail: NTIS HC A17/MF A01 CSCL 13F

The small passenger car transmission was tested to supply electric vehicle manufacturers with technical information regarding the performance of commerically available transmissions which would enable them to design a more energy efficient vehicle. With this information the manufacturers could estimate vehicle driving range as well as speed and torque requirements for specific road load performance characteristics. A 1979 Chevrolet Model 200 automatic transmission was tested per a passenger car automatic transmission test code (SAE J651b) which required drive performance, coast performance, and no load test conditions. The transmission attained maximum efficiencies in the mid-eighty percent range for both drive performance tests and coast performance tests. Torque, speed and efficiency curves map the complete performance characteristics for Chevrolet Model 200 transmission. L.F.M.

N80-28256# Lea (N. D.) and Associates, Inc., Washington, D.C.
DESCRIPTION AND TECHNICAL REVIEW OF THE DUKE UNIVERSITY AUTOMATED PEOPLE/CARGO TRANSPORTATION SYSTEM Final Report
H. A. Theumer and C. P. Elms Jul. 1979 139 p
(Contract DOT-UT-80025)
(PB80-159734; UMTA-IT-06-0188-79-2) Avail: NTIS HC A07/MF A01 CSCL 13F

The installation of the automated people/cargo transportation system at Duke University in Durham, North Carolina is reviewed. A description of the technical subsystems as well as the designed operation are included; specifications of performance, reliability, and maintainability are reviewed; and system development and implementation are summarized. Where important, the review of technical subsystems includes applicability, modifications and/or improvements for application in an urban environment. GRA

N80-28257# Transportation Research Board, Washington, D.C.
AERIAL SURVEYS, GEOMETRICS, SURFACE DRAINAGE, ECOLOGICAL IMPACTS AND SAFETY APPURTENANCES
Mary McLaughlin, ed. 1979 65 p refs
(PB80-162233; TRB/TRR-736; LC-80-13136;
ISBN-0-309-02991-0) Avail: NTIS HC A04/MF A01; Hardcopy also available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, D.C. 20418 CSCL 13B

Various aspects of highway and rail transportation are discussed. Facilities design, hydrology and hydraulics, and environmental design are among the topics covered. J.M.S.

N80-28258# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
NATIONAL CRASH SEVERITY STUDY STATISTICS Special Report, Jan. 1977 - Mar. 1978
Leda Ricci Oct. 1979 113 p
(Contract DOT-HS-8-01944)
(PB80-16040; UM-HSRI-79-80; DOT-HS-805227) Avail: NTIS HC A06/MF A01 CSCL 13L

Statistical data from accidents investigated in seven geographical areas within the continental United States is presented. The accidents were selected so that the aggregate of the areas closely resembles the urbanization distribution of the entire country. Within each area a stratified sampling plan was used to gather detailed information on passenger cars (and their occupants) in crashes severe enough to require that the vehicles be towed from the scene. The combined investigations presented account for 6,626 crashes, 8,616 towed vehicles, 14,491 vehicle occupants, and 485 fatalities. The tables and figures were generated using a computer file of national crash severity study data and represent only a very broad treatment of the data. GRA

N80-28259# National Academy of Sciences - National Research Council, Washington, D. C. Committee for Joint U.S./USSR Academy Study of Fundamental Science Policy.
SYSTEMS FOR STIMULATING THE DEVELOPMENT OF FUNDAMENTAL RESEARCH Final Report
1979 773 p refs
(Grant NSF SRS-74-21141)
(PB80-162316; NSF/SRS-7421141) Avail: NTIS HC A99/MF A01 CSCL 05A

A series of parallel investigations by U.S. and Soviet specialists on science policy in the two countries in the area of fundamental research is documented. The first two essays present surveys of the national systems for stimulating the development of fundamental research, while subsequent paired case studies treat decision making in the development of a unique scientific facility; organizational mechanisms for initiating new fundamental research projects; development of major scientific centers; using the results of fundamental research in applied problems; and retrospective analysis of the state of fundamental research in the two countries. GRA

N80-28260 Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
ANAEROBIC-ACTIVATED CARBON FILTERS FOR THE REMOVAL OF REFRACTORY AND TOXIC ORGANIC COMPOUNDS IN WASTEWATER Technical Completion Report, Oct. 1977 - Sep. 1979
Makram T. Suidan, Wendell H. Cross, Madeline Fong, John W. Calvert, and Khalique A. Khan Nov. 1979 179 p refs
(PB80-164254; ERC-08-79; WB0-04205; OWRT-A-077-GA(1))
Avail: NTIS HC A09/MF A01 CSCL 13B

An anaerobic filter with granular activated carbon was developed and tested for the effective and energy efficient treatment of waste water containing phenolic compounds. Two identical experimental reactors consisting of four jacketed columns and three clarifiers connected in series were tested. Each column had a reversible recirculation pump for the recirculation of the aqueous contents around each individual reactor. Granular activated carbon served as a media for microbial attachment, substrate concentration, and polarization. A feed substrate flow rate of 2 ml/min giving a total empty bed contact time of 46.48 hours was used with a recirculation flow rate of 50 ml/min. Two phenolic compounds, catechol and o-cresol, were tested at different organic loading rates in the reactors. GRA

N80-28261# Westinghouse Research and Development Center, Pittsburgh, Pa.
PROGRAMMABLE ASSEMBLY RESEARCH TECHNOLOGY TRANSFER TO INDUSTRY, PHASE 2 Quarterly Report
R. G. Abraham, R. J. S. Stewart, T. Csakvary, L. Y. Shum, C. Ho, W. L. Rogers, A. Meyerhoff, and R. S. Wilks Jun. 1979 60 p
(Grant NSF ISP-78-18773)
(PB80-164809; NSF/RA-790393; QR-2) Avail: NTIS HC A04/MF A01 CSCL 13H

The preliminary layout design of the end bell subassembly portion of the pilot experimental adaptable-programmable-assembly system is discussed. The design of the software for the supervisory computer and vision system is reviewed. Experiments with all small motor parts led to a final design concept for a programmable belt feeder. Benchtop tests using a special fixture and tool reduced the risk of automatic wich insertion into the end bell bearing bore. Experimentation with reflected lighting instead of backlighting using end bells and dust caps is described. Also, a large portion of graphic and tabular material is presented. GRA

N80-28262# ASL Engineering, Inc., Santa Barbara, Calif.
IDENTIFICATION OF SUPERIOR ENERGY-ABSORBING MATERIALS FOR SCHOOL BUS INTERIORS. VOLUME 1: SUMMARY REPORT Final Report, 3 Aug. 1977 - 30 Jun. 1979
Lonney S. Pauls Jan. 1980 49 p 3 Vol.
(Contract DOT-HS-7-01664)
(PB80-165269; DOT-HS-805370-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 13F

The problem of identifying and selecting superior energy absorbing materials for school bus interiors was approached by developing material selection criteria to be applied to superior energy absorbing materials currently on or nearing the market. The established material selection criteria gives consideration to: (1) high temperature performance (i.e., igniteability, flame spread, smoke emissions and toxicity, (2) shock attenuation (compliance to injury criteria), (3) energy absorption, and (4) general design (e.g., cost and weight effectiveness, environmental and vandal resistiveness, etc.). Materials were evaluated and screened, using this established criteria, and a set of preferred materials tested experimentally to verify their compliances to these criteria. Tests included flammability, dynamic drop and sled impact tests. GRA

N80-28263# ASL Engineering, Inc., Santa Barbara, Calif.
IDENTIFICATION OF SUPERIOR ENERGY-ABSORBING MATERIALS FOR SCHOOL BUS INTERIORS. VOLUME 2: TECHNICAL REPORT Final Report, 3 Aug. 1977 - 30 Jun. 1979
Lonney S. Pauls Jan. 1980 106 p refs 3 Vol.
(Contract DOT-HS-7-01664)
(PB80-165277; DOT-HS-805271-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 13F

Pass/fail criteria for flammability, smoke emissions, toxicity, energy absorption, and shock attenuation were developed for use in the selection of padding core and cover materials for crashworthy bus interiors. The materials selected were examined

for high temperature performance characteristics and vandalism resistance. Drop tests conducted to determine the impact on the torso, knee, and head and face of the 6 yr. old child as well as on the 50% adult male are analyzed. A.R.H.

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-28264 Arizona Univ., Tucson.
LOW SURFACE BRIGHTNESS SPIRAL GALAXIES Ph.D. Thesis
William Romanishin 1980 174 p
Avail: Univ. Microfilms Order No. 8015591

An observational overview of a sample of low surface brightness (LSB) spiral galaxies is presented. The sample galaxies were chosen to have low surface brightness disks and indications of spiral structure visible on the Palomar Sky Survey. Photographic surface photometry, HII region spectrophotometry, long-slit spectra and neutral hydrogen 21 cm radio observations are documented for a selection of the sample galaxies. The findings indicate that the average disk central surface brightness of the LSB galaxies is 22.88 magnitude/arcsec2 in the B passband. The average disk scale length is about 4 kpc, almost as large as for a sample of giant late-type systems. From broadband color measurements of the old stellar population, a low average stellar metallicity, on the order of 1/5 solar is inferred. The spectra and optical colors of the HII regions in the LSB galaxies indicate a lack of hot ionizing stars compared to HII regions in other late type galaxies. The average surface mass density is less than half that of a sample of normal late-type spirals. The average LSB galaxy neutral hydrogen mass to blue luminosity ratio is about 0.6, significantly higher than in a sample of normal late-type galaxies. Dissert. Abstr.

N80-28265 California Univ., Berkeley.
STELLAR EXTREME ULTRAVIOLET SPECTROSCOPY Ph.D. Thesis
Roger Frank Malina 1979 162 p
Avail: Univ. Microfilms Order No. 8014793

The feasibility of stellar extreme ultraviolet (EUV) spectroscopy is analysed. A stellar EUV spectrometer was built to carry out the observations; its design, fabrication and performance are described at length. The instrument was launched on a sounding rocket and the observation targets were the stars HZ 43, Capella and Arcturus. HZ 43 was detected from 170 A to 500 A with a 15 A resolution. The spectrum observed was marked by a prominent absorption edge of 225 A + or - 15 A with a ratio F sub lambda (230 A)/F sub lambda (220 A) = 0.51 + or - 0.13. The upper limit on the equivalent width of emission and absorption lines was 10 A. The discontinuity observed in HZ 43 is attributed to absorption at the 228 A Lyman edge of singly ionized helium. The required photospheric helium surface density is 0.00001 < or = < 0.00003 for a T sub eff = 60,000 K, as derived by comparison with existing photospheric models. If this interpretation is correct, it provides the first determination of the helium abundance in a DA white dwarf. Dissert. Abstr.

N80-28266 Cornell Univ., Ithaca, N. Y.
AIRBORNE INFRARED SPECTROSCOPY OF IONIZED HYDROGEN REGIONS AND THE GALACTIC CENTER Ph.D. Thesis
John Francis McCarthy 1980 212 p
Avail: Univ. Microfilms Order No. 8015710

Observations from a ten channel liquid helium cooled grating spectrometer developed for astronomical observations in the 16 to 30 microns region are discussed. Ten bright galactic ionized hydrogen regions have been surveyed for line radiation at 18.7 micron from the (3)P sub 2 to (3)P sub 1 transition in the ground state of doubly ionized sulfur. The 16 to 30 microns continuum spectrum of the galactic center, Sgr A West, has been measured, and the region has been mapped at 19 and 28 microns with 30 in. resolution. In the continuum spectra, a broad depression centered on 18 microns is attributed to absorption by cold silicate dust grains in the line of sight. The [SIII] 18.7 microns line was detected in nine galactic HII regions (Orion, M17, M8, NGC 6357, NGC 2024, W3, W33, W49, and W51) and mapped in M17. Comparison with the data shows good agreement for Orion, M17, and M8. In NGC 6357 the observed flux is higher than expected, perhaps because of an overabundance of sulfur. In all other cases, the observed flux is lower than expected, and dust extinction is the most plausible explanation for the discrepancy. Dissert. Abstr.

N80-28267 Princeton Univ., N. J.
HI SHELLS IN THE GALAXY Ph.D. Thesis
Esther Ming Hu 1980 76 p
Avail: Univ. Microfilms Order No. 8015122

A search was made for HI shells in the 21 cm maps for the absolute value of b > 10 degrees. A filter in the velocity dimension was used to enhance shell features over background gas. Positions, expansion velocities, column densities, and angular extents were measured for the 50 shells that were discovered. Incorporating distance estimated, masses, and kinetic energies were estimated for the shells. The distribution of HI shells was compared with the distribution of other large scale features in the galaxy: HI shell structures are found to correlate with the positions of radio continuum loops, I, II, and III and to show little relation to the distribution of O and B stars. It is concluded that HI shells correspond to supernova events in the gaseous disk. The shells may be modeled in three ways: (1) supernova remnants occurring in clouds; (2) imploded clouds in the over pressured cavities of remnants; and (3) swept out clouds within more extended supernova remnants. Dissert. Abstr.

N80-28268 California Univ., Berkeley.
A 346 GHz HETERODYNE RECEIVER AND ITS USE IN OBSERVATIONS OF CARBON MONOXIDE IN INTERSTELLAR CLOUDS Ph.D. Thesis
Neal Rider Erickson 1979 166 p
Avail: Univ. Microfilms Order No. 8014666

The design and construction of a receiver for use at a frequency of 346 GHz is described. The mixer's frequency response extends from 260-350 GHz with nearly constant sensitivity, with a system noise temperature of 3400 K at 318 GHz. When used on the 60 inch telescope on Mt. Lemmon, the J = 3 yields 2 line of CO at 346 GHz was detected in 9 sources, but pointing and baseline problems caused much of the data to be unreliable. A 14 point map was obtained of Orion A and is compared to the 1 yields 0 spectra. In the case of the central region of Orion A the similarity of the spectra is quite striking. This receiver is used to make observations in the 260-282 GHz retion using a 4.9 m telescope. Molecules observed included HCN, HCO(+), N2H(+), SO2, HC3N, H2CO and HNC. These observations established that the 1mm region is very rich in spectral lines of moderate strength, and that further observations in the submillimeter range should be quite productive. Dissert. Abstr.

N80-28269 California Univ., Berkeley.
INFRARED FINE-STRUCTURE LINE EMISSION FROM THE GALACTIC CENTER Ph.D. Thesis
John Howard Lacy 1979 156 p
Avail: Univ. Microfilms Order No. 8014767

A spectrometer optimized for detection of single emission and absorption lines from astronomical sources, in the 8 to 13 micron atmospheric window is described. Observations have been made from the galactic center source Sgr A West. These observations show a complex array of small ionized gas clouds in the central few pc of the Galaxy. Ne II (12.8 microns) emission from these sources has been both spatially and spectrally resolved. Sensitive searches were made for Ar III, S IV, and Ar V emission to determine the level of ionization of the clouds. The velocities

of the clouds indicate the presence of approximately 6 million solar mass within 1 pc of the galactic center and suggest that about half of that may be in the form of a massive central black hole. Consideration of possible means of binding individual clouds leads to the conclusion that they are freely expanding and so must be generated at a rate of approximately 1 cloud/1000 yr. Models are proposed to explain the creation, ionization, and ultimate fate of the clouds. Possible further observations which may prove or disprove the existence of a black hole are discussed. Dissert. Abstr.

N80-28270 Princeton Univ., N. J.
BROADBAND PHOTOMETRY OF GALAXIES IN TWO DISTANT CLUSTERS WITH A CHARGE-COUPLED DEVICE CAMERA Ph.D. Thesis
Marshall William Bautz 1980 142 p
Avail: Univ. Microfilms Order No. 8016163

Observations from the direct imaging channel of the Princeton Charge Coupled Device spectrometer directed toward four color broadband photometry of two distant clusters of galaxies are discussed. Data reduction techniques were developed to extract photometric information from small images of low surface brightness. These techniques were applied to obtain broadband colors in the spectral range between 5000 and 9000 Angstroms down to a limiting apparent visual magnitude of about 21.5. The observed colors show no evidence for the presence of substantial numbers of young blue stars. There is some evidence for an anomalously broad distribution of color in the spectral range between 7000 and 9000 Angstroms. Dissert. Abstr.

N80-28271*# Texas Univ., Austin.
OBSERVATIONS OF EMISSION LINES IN M SUPERGIANTS Final Report
David L. Lambert 1 Aug. 1979 5 p refs
(Grant NsG-5005)
(NASA-CR-163359) Avail: NTIS HC A02/MF A01 CSCL 03A

Copernicus observations of Mg 2 h and k emission lines from M giants and supergiants are described. Supergiants with extensive circumstellar gas shells show an asymmetric k line. The asymmetry is ascribed to superimposed lines of Fe 1 and Mn 1. The Mg 2 line width fit the Wilson-Bappu relation derived from observations of G and K Stars. Results of correlated ground-based observations include (1) the discovery of K 1 fluorescent emission from the Betelgeuse shell; (2) estimates of the mass-loss rates; and (3) the proposal that silicate dust grains must account for the major fraction of the Si atoms in the Betelgeuse shell. Author

N80-28272*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SOLAR EXTREME ULTRAVIOLET TELESCOPE AND SPECTROGRAPH FOR SPACE SHUTTLE. VOLUME 1: INVESTIGATION AND TECHNICAL PLAN
Werner M. Neupert Nov. 1978 58 p refs
(NASA-TM-80643) Avail: NTIS HC A04/MF A01 CSCL 03A

A scientific investigation of heating and mass transport in the solar corona that is currently planned for a future Shuttle/Spacelab flight is outlined. The instrument to be used is a near-normal incidence grating spectrograph fed by a grazing incidence Wolter Type 2 telescope. A toroidal grating design provides stigmatic images of the corona up to 8 arc min in extent over the spectral region from 225 A to 370 A. Spatial resolution of at least 2 arc sec and spectral resolution of 0.050 A is achievable throughout the central 4 arc min field or view. Primary scientific data are recorded on Schumann-type film. An H-alpha slit jaw monitor and zero order extreme ultraviolet monitor are also planned to support instrument operation. M.G.

N80-28273*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IUE OBSERVATIONS OF A LUMINOUS M SUPERGIANT THAT EXHIBITS INTENSE CONTINUUM IN THE FAR ULTRAVIOLET
A. G. Michalitsianos, M. Kafatos, and R. W. Hobbs Apr. 1980 21 p refs Submitted for publication
(NASA-TM-80681) Avail: NTIS HC A02/MF A01 CSCL 03A

Observations of the late type M supergiant TV Gem (M1 Iab) reveal strong UV continuum between 1200 A and 3200 A. The continuum is essentially featureless with the exception of a number of broad absorption features in the short wavelength spectra range. An absorption feature centered around 1400 A could be due to Si IV absorption found typically in spectra of middle B type stars. UV emission from this star is unexpected because earlier ground-based observations give no indication of a possible association with an early companion or circumstellar ionized nebulosity. A B9 or A1 III - IV type star approximately 2 to 3 magnitudes fainter than the M star could explain the level of UV continuum observed, but a fully self consistent explanation that includes the B-V color index of TV Gem is not as yet possible. The continuum flux dependence with wavelength in the UV spectral range could be attributed to a high energy source such as an accretion disc. It is suggested TV Gem is a good candidate for HEAO-2 (Einstein) satellite observations because a high energy object in close proximity to the M star would likely be a source of soft X-ray emission. A.R.H.

N80-28274*# Wyoming Univ., Laramie. Dept. of Physics and Astronomy.
INFRARED STUDIES OF AFGL SOURCES Final Report, Sep. 1976 - Sep. 1979
Robert D. Gehrz, John A. Hackwell, and Gary L. Grasdalen Hanscom AFB, Mass. AFGL 14 Apr. 1980 59 p refs Sponsored in part by NSF and ONR
(Contract F19628-76-C-0271; AF Proj. 7670)
(AD-A084713; AFGL-TR-79-0274) Avail: NTIS HC A04/MF A01 CSCL 03/1

The data acquired during the past three years from a promising base upon which to build a statistically complete analysis of the infrared objects populating our galaxy. Wyoming observations have also provided insight into the nature of new, and in some cases bizarre, classes of infrared sources which were discovered by the AFGL infrared survey. Many of these objects appear to represent important phases in the ongoing process of stellar birth and death. GRA

N80-28294*# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
DETERMINATION OF ASTRONOMICAL COORDINATES AT THE KLOPPENHEIM SATELLITE OBSERVATION STATION USING THE CIRCUMZENITHAL ASTROLABE VUGTK; FOR THE PERIOD 1972 TO 1975 [ASTRONOMISCHE KOORDINATENBESTIMMUNGEN AUF DER SATELLITENBEOBACHTUNGSSTATION KLOPPENHEIM MIT DEM ZIRKUMZENITAL VUGTK IN DEN JAHREN 1972 BIS 1975]
Gerhard Soltau *In its* Activities of the Kloppenheim Satellite Obs. Station 1979 p 19-27 refs In GERMAN; ENGLISH summary (For primary document see N80-28292 18-99)
Avail: NTIS HC A04/MF A01

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-28275 Cornell Univ., Ithaca, N. Y.
STAR CLUSTERS CONTAINING MASSIVE, CENTRAL BLACK HOLES: EVOLUTION CALCULATIONS Ph.D. Thesis
Alan Bruce Marchant 1980 84 p
Avail: Univ. Microfilms Order No. 8015709

Detailed, two dimensional simulations of star cluster evolution are discussed. A Monte-Carlo method is adapted to simulate the development with time of isolated star clusters. Clusters which evolve on relaxation timescales are treated with and without central black holes. The method is applied to follow the development and core collapse of an initial Plummer-model cluster without a central black hole. By extending this calculation to later dynamical stages, it is shown that core collapse occurs in a smooth, homological fashion with continual 'evaporation' of stars from the core into the developing halo. Three calculations of cluster re-expansion are presented each begining with the

insertion of a black hole at the center of a highly collapsed cluster core. Each case is characterized by a different value of initial black hole mass or black hole accretion efficiency for the consumption of debris from disrupted stars. The various re-expansion behaviors are interpreted in terms of simple quasi-static balance between cusp heating are interpreted and conduction of the heat through the core and into the halo. It is found that for the special cases examined here substantial, but not catastrophic, growth of the central black hole may accompany core re-expansion. Dissert. Abstr.

N80-28276 Ohio State Univ., Columbus.
THE DISTRIBUTION OF G5-K5 STARS IN A REGION AT THE SOUTH GALACTIC POLE Ph.D. Thesis
Raymond Charles McNeil 1980 250 p
Avail: Univ. Microfilms Order No. 8015908

An objective prism survey (dispersion 580 A/mm at H gamma) of more than 2200 late type stars is documented for an 81 square degree region at the south galactic pole (SGP). The limiting magnitude of the survey is V = 13(m)5. The objective prism classifications, photographic apparent visual magnitudes, and plate positions determined for the program stars are presented in the form of a catalog. The data are then used to discuss the distribution of the G5-M dwarfs and to derive, analytically, the space density distribution of the G5-M giants to a z-distance of 2000 parsecs. The percentage of dwarfs observed in the survey is about the same or slightly higher than the percentage found for magnitudes brighter than V approximates 11(m)5. The rate of increase in the number of dwarfs per half-magnitude interval with increasing magnitude is not great enough to be consistent with a uniform density distribution at the SGP, however. Dissert. Abstr.

N80-28277 Cornell Univ., Ithaca, N. Y.
ON THE STABILITY AND DYNAMICS OF DISK GALAXIES: CONSIDERATIONS ON THE AXISYMMETRIC BACKGROUND Ph.D Thesis
Robert Grant Hohlfield 1980 141 p
Avail: Univ. Microfilms Order No. 8015678

The stability and dynamics of the axisymmetric mass profile of disk galaxies are considered. A detailed treatment fo flat disk equilibria supported principally by rotation is given. The theory of the integral equations relating rotation curves and mass surface densities is extended. Computer programs are developed which treat the computational difficulties or relating mass surface densities and rotation curves for these galaxies. An analytic family of rotation curves and corresponding mass surface density profiles is derived which is appropriate for the representation of the flat rotation curves. The hypothesis that the dark matter at large galactocentric distances (implied by the existence of flat rotation curves) is in the form of late spectral-type stars is studied and tested. The Nyquist stability technique is generalized to a global stability technique for the study of galactic stability problems. The axisymmetric global stability problem of a flat disk of stars is reduced to the character of an eigenvalue problem, and the nature of the nonaxisymmetric global stability problem is indicated. Finally, the negative mass instability of flat galactic disks is studied in detail. Dissert. Abstr.

N80-28278 Florida Univ., Gainesville.
A NEUTRAL HYDROGEN SURVEY OF BLUE COMPACT GALAXIES Ph.D. Thesis
David Gordon 1979 157 p
Avail: Univ. Microfilms Order No. 8016535

The 21 cm neutral hydrogen line observations of 99 compact galaxies, most of the blue or very blue, are reported. Of these, 72 are detected in HI. These systems are found to be richer in HI than late type galaxies of the Hubble sequence and also to have higher surface luminosities. Approximately half of these blue compact systems are bluer than the bluest late type galaxies. Their HI velocity profiles are often narrow and single peaked, most often for the lower luminosity systems. However, the evidence suggests that the compact galaxies are rotating disk systems, perhaps with a strong central concentration of HI. The observations also indicate that at least some of these systems are quite extensive in their overall HI dimensions. It is possible that these HI rich, blue compact galaxies are old systems which have not yet completed their collapse out of the intergalactic medium. Primordial gas may be condensing into their central regions and could be the source of gas for intermittent, brief bursts of star formation. Dissert. Abstr.

N80-28279*# National Aeronautics and Space Administration, Washington, D. C.
NATURE OF TYPE 1 SUPERNOVAE
I. S. Shklovskiy Jun. 1980 37 p refs Transl. into ENGLISH of "O Prirode Sverhnovykh i Tipa". Rept. Pr-395 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-42 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76238; Pr-395) Avail: NTIS HC A03/MF A01 CSCL 03B

The nature of type 1 supernovae (SN 1) is discussed through a comparison of observational evidence and theoretical perspectives relating to both type 1 and 2 supernovae. In particular two hypotheses relating to SN 1 phenomenon are examined: the first proposing that SN 1 are components of binary systems in which, at a comparatively late stage of evolution, overflow of the mass occurs; the second considers pre-SN 1 to be recently evolved stars with a mass greater than 1.4 solar mass (white dwarfs). In addition, an explanation of the reduced frequency of flares of SN 1 in spiral galaxies as related to that in elliptical galaxies is presented. M.G.

N80-28280*# National Aeronautics and Space Administration, Washington, D. C.
NEW METHOD FOR DETERMINING THE DISTANCES TO CERTAIN EXTRAGALACTIC RADIO SOURCES
Yu. A. Kovalev Jun. 1980 15 p refs Transl. into ENGLISH of "Novyy Metod Operdeleniya Rasstoyaniy do Nekotorykh Vnegalakticheskikh Radiostochnikov", Rept. Pr-325 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1977 p 1-15 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76209; Pr-325) Avail: NTIS HC A02/MF A01 CSCL 03B

The structural evolution of variable radio sources is examined in the Hedgehog model. It is shown that the time evolution of the angular separation of two components is described by the ellipse equation. Author

N80-28281# Aerospace Corp., El Segundo, Calif. Engineering Group.
AN ANALYTICAL INTEGRATION OF THE AVERAGED EQUATIONS OF VARIATION DUE TO SUN-MOON PERTURBATIONS AND ITS APPLICATION Final Report, Oct. 1978 - Mar. 1979
C. C. Chao Oct. 1979 46 p refs
(Contract F04701-79-C-0080)
(AD-A083231; TR-0080(5473-03)-1; SD-TR-80-12) Avail: NTIS HC A03/MF A01 CSCL 20/3

The perturbed variations of the motion of Earth satellites due to the Sun and the moon are derived from a singlely averaged disturbing function. A first-order solution is obtained by analytically integrating the equations of variation including J2, J2-squared, J3, and J4. The literal expansions are carried out by computer in terms of classical elements. The secular part of the first order solution is included in the reference orbit. The orbits of the Sun and the Moon are assumed circular, and the motion of the moon is converted to the earth equatorial system with certain approximations. Results based on the GPS (Global Positioning System) satellites compare favorably with numerical integration for time spans of up to three years. An algorithm applying the first order solution has been developed to achieve the desired strategy of orbit maintenance for the GPS Phase 3 system. The analytical solutions provide insight into the long term (10 yr) variations of the orbit elements of GPS satellites. GRA

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-28282 Texas A&M Univ., College Station.
ON THE PERIODICITIES OF SATURN'S REFLECTIVITY IN THE VISIBLE Ph.D. Thesis
James Robert Johnson 1979 113 p
Avail: Univ. Microfilms Order No. 8011980

Periodogram analysis of Saturn images from 1924 to 1965 revealed an 11 year periodicity in Saturn's yellow reflectivity. A periodicity of 7 years was also seen which may be evidence of seasonal variations. Trends in the 11 year peak over the various latitude regions support evidence that a fundamental difference existed in 1977 in the absorbing particle layer, between the south polar region and equatorial zone. It is proposed that the aerospace layers are chiefly responsible for the periodic changes in the yellow reflectivity. The most urgent problem, requiring a solution for Saturn studies, is the identity of the absorbing particles and their photochemical products. Dissert. Abstr.

N80-28283 Cornell Univ., Ithaca, N. Y.
PHOTOMETRIC PROPERTIES OF CARBONACEOUS CHONDRITES AND RELATED MATERIALS Ph.D. Thesis
Linda Susan French 1980 265 p
Avail: Univ. Microfilms Order No. 8015668

Absolute reflectance spectra and limb darkening parameters were measured for one member of each of the three major petrologic types of carbonaceous chondrites: Orgueil (C1), Murchison (C2), and Allende (C3) over the wavelength range from 0.25 to 1.15 microns. The spectra of carbonaceous chondrites are flat throughout the visible and near-infrared. At some critical wavelength the reflectance begins decreasing rapidly into the ultraviolet. The limb darkening behavior of all three meteorites was analyzed according to Minnaert's law. All show some limb darkening, with values of k = 0.55-0.58 near opposition. Viking Orbiter images taken near opposition indicate the satellites are limb darkened; after correction for smearing, limb darkening parameters of 0.55-0.65 for the satellites are derived which are consistent with those of carbonaceous chondrites. The bright patches on Deimos are approximately 30% brighter than the surrounding material, a value consistent with the reflectances measured for different particle sizes of Murchison. Dissert. Abstr.

N80-28284 Pittsburgh Univ., Pa.
LIGHT SCATTERING IN A SPHERICAL PLANETARY ATMOSPHERE, WITH APPLICATIONS TO VENUS Ph.D. Thesis
David Lee Wallach 1979 114 p
Avail: Univ. Microfilms Order No. 8015333

The single-scattering reflectance was derived for a planet with a spherically uniform distribution of scatterers whose density decreases exponentially with altitude with a scale height small compared with the radius of the planet. Using a power series expansion and retaining terms to second order one can integrate the resulting expression on a programmable calculator. The planar atmosphere was found to apply for angles of incidence and exit smaller than 84. When the angles are larger than 84, it was shown that the single scattering solution could be reduced to an equivalent Lommel-Seeliger problem by using effective values of incidence and exit angles. The active zone, where most of the contribution to the brightness occurs was found to be a small region of the atmosphere in that the atmosphere can be approximated as locally planar. First-order corrections for multiple-scattering and non-isotropic scattering can then be made using the palnar expressions with an adjusted geometry. The results were applied to some of the Mariner 10 pictures of the terminator and limb of Venus. Dissert. Abstr.

N80-28285*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SYNOPTIC OBSERVATIONS OF JUPITER'S RADIO EMISSIONS: AVERAGE STATISTICAL PROPERTIES OBSERVED BY VOYAGER
J. K. Alexander, T. D. Carr (Florida Univ., Gainesville), J. R. Thieman (ORI, Inc., Silver Spring, Md.), J. J. Schauble (Florida Univ. Graduate Center, Eglin AFB), and A. C. Riddle (Cooperative Inst. for Research in Environmental Science, Boulder, Colo.) Jun. 1980 43 p refs Submitted for publication
(NASA-TM-80717) Avail: NTIS HC A03/MF A01 CSCL 03B

Observations of Jupiter's low frequency radio emissions collected over one month intervals before and after each Voyager encounter were analyzed. Compilations of occurrence probability, average power flux density and average sense of circular polarization are presented as a function of central meridian longitude, phase of Io, and frequency. The results are compared with ground based observations. The necessary geometrical conditions are preferred polarization sense for Io-related decametric emission observed by Voyager from above both the dayside and nightside hemispheres are found to be essentially the same as are observed in Earth based studies. On the other hand, there is a clear local time dependence in the Io-independent decametric emission. Io appears to have an influence on average flux density of the emission down to below 2 MHz. The average power flux density spectrum of Jupiter's emission has a broad peak near 9 MHz. Integration of the average spectrum over all frequencies gives a total radiated power for an isotropic source of 4 x 10 to the 11th power W. A.R.H.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-28286*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE PROGRAM: SOLAR ACTIVITY PREDICTION OF SUNSPOT NUMBERS, PREDICTED SOLAR RADIO FLUX
Gordon G. Johnson and Samuel R. Newman Feb. 1980 42 p refs
(NASA-TM-81109; JSC-16390; Rept-80-FM-8) Avail: NTIS HC A03/MF A01 CSCL 03B

A solar activity prediction technique for monthly mean sunspot numbers over a period of approximately ten years from February 1979 to January 1989 is presented. This includes the predicted maximum epoch of solar cycle 21, approximately January 1980, and the predicted minimum epoch of solar cycle 22, approximately March 1987. Additionally, the solar radio flux 10.7 centimeter smooth values are included for the same time frame using a smooth 13 month empirical relationship. The incentive for predicting solar activity values is the requirement of solar flux data as input to upper atmosphere density models utilized in mission planning satellite orbital lifetime studies. E.D.K.

N80-28287*# Stanford Univ., Calif. Inst. for Plasma Research.
CORONAL HEATING BY STOCHASTIC MAGNETIC PUMPING
P. A. Sturrock and Y. Uchida (Tokyo Astronomical Observatory) Jun. 1980 19 p refs Submitted for publication
(Grant NGL-05-020-272; Contract N00014-75-C-0673)
(NASA-CR-163356; SU-SUIPR-809) Avail: NTIS HC A02/MF A01 CSCL 03B

Recent observational data cast serious doubt on the widely held view that the Sun's corona is heated by traveling waves (acoustic or magnetohydrodynamic). It is proposed that the energy responsible for heating the corona is derived from the free energy of the coronal magnetic field derived from motion of the 'feet' of magnetic field lines in the photosphere. Stochastic motion of the feet of magnetic field lines leads, on the average, to a linear increase of magnetic free energy with time. This rate of energy input is calculated for a simple model of a single thin flux tube. The model appears to agree well with observational data if the magnetic flux originates in small regions of high magnetic field strength. On combining this energy input with estimates of energy loss by radiation and of energy redistribution by thermal conduction, we obtain scaling laws for density and

temperature in terms of length and coronal magnetic field strength. Author

N80-28288*# Lockheed Missiles and Space Co., Palo Alto, Calif.
ROCKET STUDIES OF SOLAR CORONA AND TRANSITION REGION Final Report, Mar. 1976 - Aug. 1979
L. W. Acton, E. C. Bruner, Jr., W. A. Brown, and R. A. Nobles Sep. 1979 55 p refs
(Contract NAS2-9181)
(NASA-CR-160001) Avail: NTIS HC A04/MF A01 CSCL 03B

The XSST (X-Ray Spectrometer/Spectrograph Telescope) rocket payload launched by a Nike Boosted Black Brant was designed to provide high spectral resolution coronal soft X-ray line information on a spectrographic plate, as well as time resolved photo-electric records of pre-selected lines and spectral regions. This spectral data is obtained from a 1 x 10 arc second solar region defined by the parabloidal telescope of the XSST. The transition region camera provided full disc images in selected spectral intervals originating in lower temperature zones than the emitting regions accessible to the XSST. A H-alpha camera system allowed referencing the measurements to the chromospheric temperatures and altitudes. Payload flight and recovery information is provided along with X-ray photoelectric and UV flight data, transition camera results and a summary of the anomalies encountered. Instrument mechanical stability and spectrometer pointing direction are also examined. A.R.H.

N80-27745# Physikalisch-Meteorologisches Observatorium, Davos (Switzerland).
THE SOLAR CONSTANT AND ITS SPECTRUM
C. Froelich *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 91-94 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-28289*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE X-RAY SPECTRUM OF QSO 0241+622
D. M. Worrall, E. A. Boldt, S. S. Holt, and P. J. Serlemitsos Feb. 1980 27 p refs Submitted for publication
(NASA-TM-80645) Avail: NTIS HC A03/MF A01 CSCL 03B

Proportional counters on the OsO-8 spacecraft measured the X-ray spectrum of QSR 0241+622 in the range 2-50 keV. The best power law fit has a proton spectral index and 90 percent errors gamma = 1.93 (+0.5, -0.3) and low energy absorption consistent with reported gas column densities, but a thermal bremsstrahlung form with temperature 13.1 keV cannot be excluded. No indication of spectral variability is found in three observations of the source with HEAO-A2, although a possible 15-30 percent intensity change over a period of 6 months was observed. The quasar is similar to 3C 273 in the proportion of energy emitted in various bands, excluding the radio, if reported radiation above 50 keV from its direction is indeed associated with QSO 0241+622. The two quasars are compared and possible energy generation scenarios are discussed. Implications concerning quasar contributions to the diffuse background are discussed. A.R.H.

N80-28290*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE HEAO A-2 SURVEY OF ABELL CLUSTERS AND THE X-RAY LUMINOSITY FUNCTION
J. D. McKee, R. F. Mushotzky, E. A. Boldt, S. S. Holt, F. E. Marshall, S. H. Pravdo, and P. J. Serlemitsos Apr. 1980 42 p refs Submitted for publication
(Contract NAS8-33348)
(NASA-TM-80680) Avail: NTIS HC A03/MF A01 CSCL 03B

The HEAO A-2 all sky data base was surveyed for 2-10 KeV X-ray emission from the 225 Abell clusters og galaxies listed in Abell's (1958) catalof which are of distance class four or less, and are within the fraction of the sky surveyed completely by Abell. Thirty-two identifications of clusters with X-ray sources were made, for which 2-10 KeV fluxes and 90% error boxes are presented. Twelve of these identification are new. The X-ray luminosity function was derived for this statistically complete sample and the best exponential fit was found to be f(L) = 20.2 x 10 to the minus 8 power exp (-l(44)/1.9) per cu Mpc 2-10 KeV. The relationship between X-ray luminosity and richness was examined and a correlation was found for richness classes 0, 1, and 2. The relationship of X-rau luminosity, Bautz-Morgan type, and Rood-Sastry type was examined. It was found that BM type I's and RS type cD and B have the greatest average luminosity. The contribution of clusters to the X-ray background was calculated from the luminosity function and was found to be 5%, and with 90% certainty, less than 8% in the 2-10 KeV band pass. A.R.H.

N80-28291# National Technical Information Service, Springfield, Va.
COSMIC RAYS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Mar. 1980
Brian Carrigan Apr. 1980 82 p Supersedes NTIS/PS-79/0387; NTIS/PS-78/0406
(PB80-807647; NTIS/PS-79/0387; NTIS/PS-78/0406) Avail: NTIS HC $30.00/MF $30.00 CSCL 04A

Measurement techniques, isotopic composition, distribution, intensity, anisotropy, and sources of cosmic rays are covered in the citations. This updated bibliography contains 75 abstracts, 22 of which are new entries to the previous edition. GRA

99 GENERAL

N80-28292# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
[ACTIVITIES OF THE KLOPPENHEIM SATELLITE OBSERVATION STATION]
Hansdieter Grosse and Gerhard Soltau 1979 10 p refs In GERMAN; ENGLISH summary
(Ser-B-230) Avail: NTIS HC A04/MF A01

The activities of the Kloppenheim satellite observation station are described. The determination of the station's position in longitude, latitude, and astronomical azimuth subsequent to its participation in the West European Satellite Triangulation Network and the verification of the measurement constancy of a circumzenithal astrolabe relative to the determination of astronomical coordinates, are discussed. For individual titles, see N80-28293 through N80-28294.

N80-28293# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE KLOPPENHEIM SATELLITE OBSERVATION STATION: DETERMINATION OF LONGITUDE, LATITUDE, AND ASTRONOMICAL AZIMUTH WITH THE PASSAGE INSTRUMENT Ap 70 [SATELLITENBEOBACHTUNGSSTATION KLOPPENHEIM BESTIMMUNG VON LAENGE, BREITE UND AZIMUTH MIT DEM PASSAGEINSTRUMENT Ap 70] c43
Hansdieter Grosse *In its* Activities of the Kloppenheim Satellite Obs. Station 1979 p 5-19 refs In GERMAN; ENGLISH summary (For primary document see N80-28292 18-99)
Avail: NTIS HC A04/MF A01

The Kloppenheim satellite observation station is a participant in the activities of the West European Satellite Triangulation Network. As such its astronomical coordinates had to be determined. The determination of the longitude and latitude as well as of the astronomical azimuth of the reference station are described. The procedure of automatic registration of the time contacts was used for the longitude and azimuth. Author (ESA)

N80-28294# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
DETERMINATION OF ASTRONOMICAL COORDINATES AT THE KLOPPENHEIM SATELLITE OBSERVATION STATION USING THE CIRCUMZENITHAL ASTROLABE VUGTK; FOR THE PERIOD 1972 TO 1975 [ASTRONOMISCHE KOORDINATENBESTIMMUNGEN AUF DER SATELLITENBEOBACHTUNGSSTATION KLOPPENHEIM MIT DEM ZIRKUMZENITAL VUGTK IN DEN JAHREN 1972 BIS 1975] c99
Gerhard Soltau *In its* Activities of the Kloppenheim Satellite Obs. Station 1979 p 19-27 refs In GERMAN; ENGLISH summary (For primary document see N80-28292 18-99)
Avail: NTIS HC A04/MF A01

The verification of the astronomical system of longitudes of the Federal Republic of Germany, performed in 1973/74, at the Kloppenheim station is described. Longitudes and latitudes were determined in measurement sets for a period of several years by means of the circumzenithal astrolabe VUGTK-CSSR. The results are shown. The coordinate values, obtained at different external conditions, do not show ascertainable systematics. They provide an excellent constancy for the measuring system.

Author (ESA)

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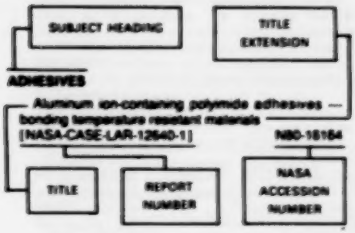
Typical Subject Index Listing



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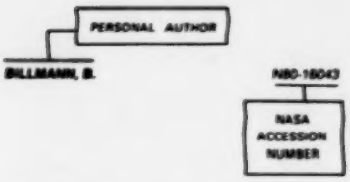

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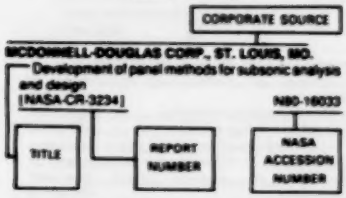

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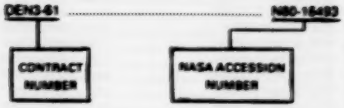

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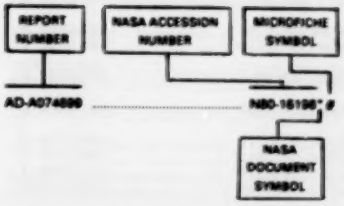

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